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OF
CORNWALL.

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The CONSTITUTION of the STANNARIES;

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By WILLIAM BORLASE, A. M. F. R. S.

Rector of LUDGVAN, and Author of the ANTIQUITIES of CORNWALL.

----- *Natale solum dulcedine captos*
Ducit.

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MDCCLVIII.

T O T H E
NOBILITY and GENTRY
O F T H E
COUNTY of CORNWALL,

With great Respect.

IT cannot be questioned, Gentlemen, but that NATURAL HISTORY is a most extensive Science, taking in all animate and inanimate substances which Land, Air, or Water contain; explaining their relations, properties, and uses; and, in short, giving a recital and detail of the whole visible Creation.

NOR is it a science less entertaining than comprehensive; for if the mind thirsts after variety, and a fresh succession of objects, where can she find for contemplation so numerous and various a treasure? If it is solicitous after curious workmanship, where such fine mechanism as in the Animal œconomy, from the Elephant to the Pismire? If studious of beauty, shape, and colouring, where such gracefulness as in Man, such tints, delicacy, and lustre, as in Flowers, Birds, Fishes, and Precious-Stones? If moved chiefly by the most astonishing scenes of grandeur, we need but look upon the Cliffs or Mountains, upon the Ocean or the Sky.

BUT the mere transient gratifications of a curious and inquisitive mind would not give this study its deserved and allowed pre-eminence, if it could not, in an equal degree, instruct as well as please; if it did not correct and exalt, as well as amuse and engage the mind.

'TIS

'Tis true, this large field, so fertile in matter and fully stock'd for observation, with all its varieties is but a blank and dreary desert to the heedless and inattentive traveller. Bounteous Providence has laid her works before us; she has opened the spacious volume of Nature; 'tis our part to read, compare, and understand.

NATURAL HISTORY is the handmaid to Providence, collects into a narrower space what is distributed through the Universe, arranging and disposing the several Fossils, Vegetables, and Animals, so as the mind may more readily examine and distinguish their beauties, investigate their causes, combinations, and effects, and rightly know how to apply them to the calls of private and public life.

IT fills the active and more social mind with ideas, and experimental deductions, profitable to the community, and productive of manufactures, additional employ and commerce. It enables the retired and studious mind to prosecute her contemplations, make discoveries and calculations, plan improvements, and assist speculation; but above all, raises the mind, in both circumstances, to the Author of all these things.

THE principal use therefore of Natural History, is, that it leads us directly to Religion; it shews us every where the plain footsteps of design and intelligence, and points out to us all the attributes of GOD.

WHAT arguments and words shall seldom compass, the smallest and least considerable of these works shall effect irresistibly; the eyes of a fly, the wing of an insect, the scale of a fish, shall manifest a Deity to any person, who will pursue effects up to their causes, beyond contradiction, and above all doubt.

LOOK where we will, admiration seizes us; we perceive the strength and immensity of some works, as well as the inimitable skill of others; and we revere the *Power*, as well as see the *Wisdom* of their Great Author; we observe the splendor and excellency of other

other works, and we stand convinced of his GLORY ; we find the uses, shapes, and properties in all things different, yet we find them all conspiring to promote universal, mutual good ; we see them all directed so harmoniously to one point for the good of the whole, that they must needs proceed from one only, constantly beneficent, and GRACIOUS GOD. From these we deduce and argue the other attributes, and derive our own duties, till Natural Religion ends ; but whilst we are thus enlightning our understanding, and admitting that prospeet of the Deity which is displayed in his works, gratitude, awed and mixed with reverence, supples the heart, and disposes it most effectually to embrace all the sublime and inestimable truths of Revelation.

THESE are the undeniable and beneficial consequences of NATURAL HISTORY in general ; but of this noble Science, of this stately tree of Knowledge, the NATURAL HISTORY of a particular district (such are as the following observations) is but a branch ; it is confined and local, and must tend chiefly to the description and improvement of one particular spot.

THE situation of this county (secluded in a manner from the rest of Britain) renders it, like all distant objects, less distinctly seen and regarded by the polite, learned, and busy world ; yet whatever concerns its interest and reputation, it need not be urged, Gentlemen, may have some claim to your attention, who have a natural connexion with, and relation to it.

IT matters less to strangers whether the arts in a distant county flourish, are at a stand, or decay ; whether the several Natural Productions are well or ill managed, understood or not ; justly estimated and disposed of, or otherwise ; but these things are most proper and interesting disquisitions for the inhabitants.

To awake attention to the real and publick interest of the County, it was necessary to shew the present state of Knowledge with regard to Arts and Metals, and in many particulars to hint at

alterations and suggest improvements ; better expedients very likely may occur to others, but some are requisite. In speaking of the Inhabitants, truth required that general failings should be confessed, as well as what deserves the character of martial spirit, ingenuity, taste, and industry recorded. For both these I make no apology ; neither to the publick for mentioning the latter with commendation, nor to you for reprehending the former ; concluding that it is more for the honour of our Country to express our disapprobation of every thing that is ill, than, by endeavouring to conceal and palliate, to incur the imputation of patronizing error, or disguising truth.

To pre-engage your favour, and bespeak your applause, was in no wise, Gentlemen, the intention of this address : I am persuaded such an application would be as vain and impotent with regard to you, as it would appear frivolous to the rest of the world. The fate of the following work must rest on its own utility, the diligence, discernment, (if any) and integrity of the Author, or deservedly fall for want of these its only just supports.

ACCEPT however my most ardent wishes (the publick will readily forgive this partiality) for my native County and you. May the subject of these papers, CORNWALL, (formerly reckoned among the Kingdoms of this Island, and at present still more regarded for its Natural Productions as they become more known) flourish - - - under the inspection of its owners.

MAY you, Gentlemen, adorn your ancient names and inheritances with every virtue, national, social, and domestic ; concur with harmony in promoting every rational, public-spirited improvement ; by the influence of your example give weight and countenance to religion and good manners ; by your authority restrain the vicious ; by your charity relieve the indigent, and generously employ the industrious.

THESE are the wishes, hopes, and prayers of

The A U T H O R.

SOME introductory Explanation of the Rise of the following Treatise, the Difficulties which interfered, the Assistances to be acknowledged, the Method, Plan, and Connexion of the whole Work, and the undeniable Imperfections in the Execution of it, must here be premised, and submitted

T O T H E
C A N D I D R E A D E R.

BEING solicited, about twenty years since, to make a collection of Cornish fossils, for some learned gentlemen abroad, whose names would entitle them to a much superior correspondence^a, and finding the natural products of this County much commended; being also frequently employed afterwards in the same office, I became more and more fond of collecting, till my specimens tempted me more narrowly to inspect and describe them: Several incidents, relating to NATURAL HISTORY, in the mean time occurred, and claimed a notice, which I could not deny them: My country was little known, and my desire to survey the several parts of it increased, as the deficiencies of what had been published before became more apparent, and not being wholly destitute of those who urged me to this undertaking, I became engaged by degrees, and insensibly ventured myself so far in the following work, that I could proceed with more ease, than I could retreat with propriety.

MY situation however, was none of the most favourable to such an attempt; my distance from books and those assemblies of the learned who had turned their studies into the same chanel, was a discouraging, and in some particulars, an insuperable disadvantage, but with regard to the natural productions, it enabled me to examine them all on the spot, and though I had not always before me what the *Literati* had written on the same subject, I could better understand what nature had done.

MR. Ray and Mr. E. Lluyd (both most deservedly eminent in Natural Knowledge) came into Cornwall in quest of what was remarkable, and stayed here some time. The former has diligently taken a list of our Fish and Plants; and though Antiquity participated the attention of the latter, yet he made some discoveries in each department, and thereby concurred to render them less difficult to those, who were to succeed him in the same researches. Dr. Woodward's

^a Dr. Boerhave, Dr. J. Frederick Gronovius, Dr. Linnæus, and the late Dr. Isaack Lawson, then at Leyden.

Method, and Catalogue of Fossils, afford many critical descriptions of a number of Specimens from Cornwall, and many useful theories deduced from them. Some scattered Memorandums on our Metals, and Mines, &c. are to be found in the Transactions of the Royal Society, and the late Mr. Hutchinson made some just observations on our Strata and Lodes. I have not made the least advantage of either without naming place and author.

Language. FEW Studies are more useful to mankind than NATURAL HISTORY, but it is a particular Science, and to read it with pleasure and improvement (as there is a connexion betwixt Sciences as well as Arts) will require some previous and preparatory knowledge of the learned Languages, and indeed of the sister Sciences.

FOR want of sufficient and adequate expressions in the English tongue NATURAL HISTORY must needs borrow from the Greek and Latin. It must also struggle to naturalize the technical terms of Geometry, Geography and other Arts, in short, a Natural Historian for the sake of properly particularizing such a variety of bodies as fall within his notice, must have the liberty of taking words from every hand ; the sense would escape in long sentences and a multitude of words ; and the unavoidable circumlocutions of the English tongue, if they did not destroy the meaning, would necessarily abate the impression.

THESE technical words, however, are inserted with reluctance, and in such places more especially as by their abstracted speculations are calculated for the perusal of those who are most conversant in these studies.

Method. THE Method which the principal divisions are thrown into is plain, such as the several parts of the Treatise suggested, not confined to any system ; nor the Subjects treated under the general heads, classed and digested according to the method of any other Writer.

As the end of Method is perspicuity, when it appeared to me that I was in possession of that, I never thought it necessary to search in books for the other. I follow no leader, but I have slighted no guidance, nor refused to accept of any clue to regulate my conduct : there may be too much of System, as well as too little ; Subjects may be crammed so close, that they will hide one another ; if they are arbitrarily driven together under a class less obvious, they will not suit their companions, nor become their place, nor be easily found.

BUT without an orderly disposition NATURAL HISTORY fares much worse, 'tis but a confused, undisciplined crowd of subjects ; distinct, clear arrangement places them in their due light, without which, as the eye can see no beauty, the mind can judge of no properties, competition, or relation. Though there must be no shackles, yet order, connexion, rank, and relation, must be strictly observed, and therefore with other lovers of NATURAL HISTORY I here take a pleasure

pleasure in acknowledging my obligations to him¹ who with a certain brevity and happiness, peculiar to himself, has been indefatigable in digesting the several products of Nature into the regularity and comprehensiveness of Systems, although a few obscurities, and perhaps improprieties may remain yet to be retouched.

As I tye myself down to no determined Plan, I confine myself to no man's Hypothesis, nor indulge myself often in such fallies of the imagination. It must be referred to the acute and patient reader, whether there is any Hypothesis here, but what appears to him upon cool and sufficient tryal (as it really does to the Author) either to be supported by a variety of facts, or the easy plain result of the nature of things.

To banish all Hypothesis, whilst so many points of NATURAL HISTORY Hypothesis. remain disputable and undecided, would be to obstruct one, (and no inconsiderable one) of the avenues to Knowledge. All cautious Hypotheses must be pardoned for aiming at Truth, although they miss the mark.

BUT an Hypothesis may be too bold, and when Authors pretend to account for every thing, they are not aware how indecently they intrude into the councils and peculiar province of their maker. There are many secrets in nature, which man had better let alone, and wisely own his ignorance. GOD has given us a sagacity to discern, and faculties to use his works; but in a gross only, and collective state; he has given us no talents to track the first principles through their several migrations and meanders, to transmute, destroy, and recompose the works of Nature; he did not design that we should presumptuously revise, mimick, or make, but use, revere, and celebrate his works. NATURAL HISTORY therefore has its bounds, which if it exceeds, it gets wilfully into the dark, and consumes our time in endless and futile disquisitions; NATURAL HISTORY has its bounds, most apparent to those who know most of it; among the rest of its uses therefore (upon proper intimacy) it will certainly teach us a due estimate of our own weak abilities, short-sighted fancies, and at the same time the unlimited unfathomable depth and height of the Works of GOD.

SOME pains, it will be easily allowed, have been taken to describe and engrave Engravings, such a number of subjects, but pains of this kind, I agree, do not always merit success, neither are they entitled to commendation, but when they are aptly and judiciously employed for the illustration of truth, and settling some new or doubtful part of useful knowledge.

As it might be some satisfaction to posterity (I think every one is agreed that it must be so to us) to see the patrimonial habitations of their ancestors, I have

^b Linnaeus Professor at Upsal, in Sweden.

inserted the seats of such gentlemen as expressed their desire to have them engraved; the fronts were all measured, and (which has not, I apprehend, been yet done in such collections) all printed by the same Scale ^c (to be applied to the fronts only) except two, whose owners chose to have their houses less, that more of the adjoining country and their own plantations might be inserted. For these plates I am obliged to the Proprietors.

IN the other plates, the subjects engraved, are either of the natural size, or by a scale annexed in the same plate; for want of which regulation, great obscurity has attended the engravings of some of the most celebrated authors, whilst fish and birds, cattle and fossils, are represented without due relation to the size of one another. The Subjects engraved are not always new, but the drawings were made from nature, and may be of service upon many occasions, where authors who have gone before, either could not themselves delineate, or had no opportunity of seeing the natural subjects, and were obliged to make drawings after relations, and the hasty sketches of others.

NOT always aiming at what is new, much less at what is marvellous, the Author contents himself with faithfully representing the natural bodies which came under his examination, as the best method of adding his mite to Natural Knowledge, and of making some advances, sure perhaps, though not many.

IN the account of Fossils I may seem tedious and too minute to those who have no propensity to such studies, but let it be considered that they are the distinguishing products of our County, and to those who are sensible of what use it is to have these bodies critically characterised, I wish I may not appear too short and unsatisfactory.

As our birds, and plants, and quadrupeds cannot be supposed to be very different from those of the other parts of England, and have mostly been described before, they take up less time of the Reader here.

A FEW pages of the book which follows ^d were published in the Philosophical Transactions of the Royal Society, but they were always intended as parts of this Work, detached indeed and sent before, though not irrevocably given up by the author, and as dispersed fragments (unless I am misinformed) I had a right to revise, and re-unite them.

^c The Scale is only affixed to the first house, viz. Plate iv. page 51.

^d Treatise of the origin and properties of Cor-

nish crystals; a thunder-storm in the parish of Gulval; and the agitation of the Sea, on the first of November, 1755.

BESIDES these repetitions of prior observations, there are doubtless many mistakes and faults, as well as errors of the press. I shall be willing to acknowledge the former, and from the animadversions of the more knowing, expect the pleasure of becoming better informed. I print a list of the latter, as far as a most impartial revisal could discover.

IT could not be otherwise than that several particulars of the following work Local obser-
should relate only to Cornwall, and are of little importance to the generality of vations.
the world ; but those circumstances, which concern not the bulk of mankind,
the Reader will be so good as to consider, may claim the most serious thoughts
from the inhabitants of the County, and to their service only, he will be content
that they should be consigned.

IN the descriptive part, I have been greatly obliged to the Survey of Cornwall, published in the year 1602, by Richard Carew, of East Anthony, in Cornwall, Esq; who to the nobility of his descent, added all the qualifications of the gentleman, scholar, and christian : his sharp apprehension, and strong sense, left few topicks unexamined, many, for the knowledge of his time, well noticed.

IT would have been ungenerous to his memory, as well as distressing and impoverishing my Subject, to have neglected his work, tho' he is neither slavishly copied, or ever made use of without acknowledgment. Mr. Scawen's MS relating to Cornwall I am also obliged to, especially with regard to the Cornish Language.

THE geography of Rivers, Harbours, and Creeks, I found extremely deficient ; I am therefore the more particular in tracing their courses and names, in which the Itinerary of Leland has assisted me.

I HAVE added a Map, not to travel by, or with an intent to correct the Maps already published, (of which Martin's has been of most use to me) this must be done by better hands ; but purely for the service of those who will read the Antiquities and Natural History of Cornwall.

FOR several informations in the above mentioned particulars, I have been obliged to some gentlemen now living, and for that reason, I have mentioned them only in those parts of the work, concerning which they were so good as to communicate their Observations.

IN the following work then, if the Reader shall miss any entertainment which he might expect, he will perhaps meet with nothing partial, assuming, or offensive.

five. The utility of our harbours is not magnified, nor their inconveniences concealed; if the good character which I give the inhabitants, exercise the patience of the uninterested reader, the proper contrast which Truth required will deserve his acknowledgment of impartiality. The revenues of the County's staple-commodities are calculated by the most discerning and conversant in those particulars, and therefore not exaggerated, nor the beauty of our natural productions too highly extolled. Some privileges which we have in preference to other counties, I do not challenge as our due, and the present state of Arts is so far from being heightened, that it is thought to stand in need of many improvements. Allowances will be made, I trust, for local descriptions, but I desire no quarter for misrepresentations. 'Tis the business of a Civil Historian, faithfully to draw the characters of mankind, and the motives, origin, connection, and the good and evil tendencies of their actions; 'tis also equally the duty of a Natural Historian to be faithful in exhibiting the works of Nature, to point out the defects of Science, and the imperfections of Arts, to endeavour to rectify what is amiss, and promote the advancement of what is immature.



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NEW MAP
of the County of
CORNWALL.



Latitude of the Town of Liskeard.

SCILLY ISLANDS



NATURAL HISTORY O F CORNWALL.

C H A P. I.

The General Description.

CORNWALL, the westernmost County of Britain, in its form resembling a Cornucopia, has the Bristol Chanel (a branch of St. George's) on the North, and on the South the British Chanel; which two parts of the Ocean meeting as it were in a point at the West, enclose all but the Eastern part of Cornwall, where it butts upon Devonshire. In the parish of Morwinstow, about four Miles from the North Chanel, is a tenement call'd Shorston, on the outskirts of which is a large Common called Shorston-moor, divided from Bradworthy Parish in Devonshire by a hedge for about forty land-yards to the East, then by a hedge of about a quarter of a Mile long, from the Parish of Hartland, Devon; then it butts on the parish of Wellcombe, Devon, from which it is divided also by a hedge of about a mile in length, and this hedge is therefore the limit of Shorston Tenement, to the East and North of the parish of Morwinstow, and of the County of Cornwall, till you come to Goosham Mill, where a small brook call'd Marsland Water, that rises near Woolleigh Burrows takes place and divides Cornwall from Devon along to the North Sea. All the rest of Cornwall (with a few Exceptions to be taken notice of in their proper place) is divided from Devon by the river Tamar, which rises on the very ridge of Shorston Moor, about half a mile East of Woolleigh Burrows, and when it passes out of the Tenement of Shorston commences the general Boundary of Cornwall towards the East, till it joins the Ocean near Plymouth after a course, nearly South, of about forty miles.

The two most distant points of this County are the Eastern angle of the parish of Morwinstow near the source of the Tamar, to the East, and the Promontory call'd the Land's-End, in the parish

of Senan to the West, from which extremities this county measures seventy-eight miles and a half in length, * in a line nearly South West and North East.

In the widest part, viz. from the Northern point of Morwinstow to Ramhead, is forty-three Miles and a quarter, the line nearly South South East: The land grows narrower as it goes to the West, and at about one third of its length it is but eighteen Miles from Fauwy on the South sea to Padstow on the North. As we advance another third, 'tis thirteen miles from Pendinas Castle on the South to Portreath on the North; and from Mount's Bay on the South, to St. Ives Bay and the Bristol Channel on the North, the land is but five miles wide.

The land thrusting itself forward in such narrow dimensions, declines towards the sea on either side, consequently the land is highest in or near the middle, where it is less cultivated than in the lower lands, as indeed less capable of cultivation: here, however, as our greatest Roads pass, and mostly through large Commons, and on or near the most mountainous parts, the rude prospect is apt to give travellers a more unfavourable opinion of the County in general than it deserves; for this barrenness is no more than the natural consequence of high situations in all countries, which being more exposed to the course of winds and rain than the plains and valleys, the soil is not suffer'd to rest here, but is perpetually wash'd off into lower and more even situations, the Rocks and Karns are laid bare, and the heathy soil that remains betwixt them is fit for little but to yield common pasture, and turf for fuel.

On the Northern Coast the land is generally high, and the valleys short, narrow and quick of descent; the sea therefore, besides the two creeks of Bude and Gannel) finds a way only to make two havens, Padstow and Heyle, and those fit for but Small Craft, but the valleys being more extended and level on the south coast, the sea makes an open entrance into Hammoze, Fauwy and Falmouth Harbours for the largest ships, and by their several branches as well as at Loo and Helford, affords easy carriage of all conveniences, either by ships, boats, or barges.

Near the sea, and along the sides of navigable rivers, and in the plain grounds, this county is well cultivated, and in some places well planted, but our plantations make the less figure because they are low, and our hills are naked.

It need not be here observed that Cornwall is famous for Tin and Copper Mines. The high lands in the East, bordering

* According to Martin's Map, done from an actual Survey.

upon

upon Devon, ^b did formerly afford some Tin, but now there is very little Tin east of St. Austel ^c. From St. Austel westward to Kenwyn Gwenap, Stythien, Wendron, Breag, on the South, and to St. Agnes Redruth ^d, Illogan, Camborn, Gwincar, in a straight line through Lannant, Senor, and Morvah, to the parish of St. Just on the North, the Tin and Copper Grounds maintain a breadth of about seven miles at a medium.

By the descent of the River Tamar, the lands of Morwinstow where this river rises, should be reckoned the highest hills in this County; but the length of a river's course is no infallible criterion of the height of it's source: Caradon Hill, near Liskerd, may be reckoned amongst the highest grounds, being found ^e to be 1186 feet above the level of the sea. Routor and Brownwilly must be still higher, the former being the first land discovered at sea by ships bearing for England, if I am rightly informed.

By the Domesday Book (in the Church Library at Exeter) which in all probability was the copy of the Original Survey of the Western Counties, whence the great Domesday Book in the Exchequer was partly composed, the Hundreds are thus named: 1. Conarton; containing 33 Hides ^f. 2. Tibesterna, alias Tibesta, now a Dutchy Manor, to which Granpont and most of the parish of Creed, and other dependencies belong, containing 61 Hides and a half. 3. Winnenton, alias Winneton, alias forsitan Winnianton, formerly a considerable Manor of the Arundels of Lanherne, giving name to the parish now call'd Gunwallo ^g, containing 36 Hides and a half. 4. Stratton, in which there were 83 Hides and three Virgates of land ^h. 5. Fauiton, consisting of 43 Hides and a half 6. Rialton, consisting of 69 Hides and six Farthings ⁱ of land. The 7th Hundred before the Conquest was that of Pauton ^k, containing 44

^b In the parishes of Linkinhorn, on Hengstendown, &c.

^c This name is written differently, St. Au-stelles, (Leland, vol. iii. pag. 20.) quasi Holy Altar, as if the parish had it's name from some remarkable Altar there of great resort; as the parish of Altarnun had that name from a famous Altar of St. Nunne. In vol. vii. of the same Itinerary, pag. 111, 'tis call'd St. Austols, with this marginal note [St. Austol, erat Hermita]. It is also call'd St. Austol in the Bishop's Register at Exeter; and it is imagined by a learned gentleman, (Rev. Dr. Milles, Chaunter of Exeter) that the proper way of writing this name is St. Auxil, ^a corruption of St. Auxilius an Irish Bishop.

^d Rechtius Ryddruith.

^e By the Rev. Mr. Haydon's portable Barom^t.

^f Conarton was an ancient Manor formerly belonging to the Crown of England, and in time of Hen. III. convey'd by letters patent (yet to be seen (says Hals, in his MS. of Cornwall) at Lanherne, together with the Baylywic of the Hundred of Penwith, to Simon Pincerna (or Butler) Lord of

Lanherne, in lieu of the Lordship and Manor of St. James at Westminster. In the name of Pincerna it continued till Edward III. when one of the Heiresses of that family, (i. e. of the Pincerna's) was married to Arundel of Trembleth, direct ancestor of the last Sir John Arundel of Lanherne.

^g Norden, pag. 46.

^h Eight Virgæ made a Hide; the Virga or Virgata of land was an uncertain and very different measure in different places, it sometimes consisted of 24 Acres, sometimes of 30, 40, and sometimes only of 20, 15, or even but 4 Acres. Spelman. Gloss. in voce virgata.

ⁱ A Farthing Land was like the other Measures of our ancestors, various; sometimes consisting of ten Acres, sometimes of 30. "Divisiones nuf-
" quam æquæ nec partium quantitas usquam
" certa." Spelm. Gloss. p. 320.

^k Rialton and Pauton, though they lost the honour of giving name to Hundreds, retain'd even to Queen Elizabeth's time the privilege of sending Bayliffs to attend the publick services as the Hundreds did. Carew. p. 86.

Hides, in Carew, (p. 47.) said to contain 120 Acres; i. e. Cornish Acres. This was the ancient division, probably made by Alfred the Great, who is said first to have divided the Saxon Kingdom into Hundreds.

Cornwall is at present divided into nine Hundreds; East, West, Poudre, and Kerrier spread the South Coast; Stratton¹, Lysnewyth, Trig, Pidre, and Penwith the North. When this present Division was first introduced has not occurred to me, but it certainly existed before the Lincoln Taxation, A. D. 1288, the parochial Churches being therein rang'd according to the present Hundreds; I am apt to think therefore, that a new Division took place soon after the Norman Conquest, the former Divisions appearing by the Surveys of William the First, to be not sufficiently distinct; for about this time, says Mr. Carew, "^m the country was sorted by a " more orderly manner into parishes, and every parish committed " to a spiritual father;" perhaps there was then also, if we may guess by analogy, a more orderly division of the county into the present Hundreds; the large ones were reduced and split, and the names of ancient Manors gave place to other names more expressive of the situation, or at that time better entitled to give name to the district.

It is not easy to discover the limits of the ancient Division, and to reconcile it to the present. Conarton (it may be asserted with great probability) included the present Hundred of Penwith; for the Lord of the Manor of Conarton, has been Lord also of all the Hundred of Penwith from the time of Henry III. (see note ^f in the preceding page) and there is but one Court Leet held for both the Honours, which implies some more than ordinary union. Among the rest there is not the like connexion; but what was anciently call'd Tibesta included, as I imagine, the Hundred of Poudre: Winnenton, Kerrrier: Stratton, formerly extensive, makes at present the three small Hundreds of Stratton, Lysnewith, and Trig: Fauton contained the Hundred of East, as I suppose, and the southern part of West Hundred: Rialton most part of Pidre: and Pauton the rest of Pidre, and of the Hundred of West.

In the nine Hundreds are contained, according to Camden and Speed, (p. 21.) one hundred and sixty one Parish Churches; according to others about one hundred and eighty; but Martin in his Index Villaris, one hundred and ninety eight: some reckoning the Chapels of Ease and their Appendixes, others only the Mother Churches.

¹ In the Lincoln Visitation the two Hundreds of Stratton and Lysnewyth are joined together, and called Decanatus major Terglshire, as that now called Trig is termed Dacanatus minoris

Terglshire. Trig signifies the Influx of the Sea, and from the arm of the Sea at Padstow the division of the bordering land had probably its name.

^m Survey of Cornwall, p. 82.

The latest observations relating to the Latitude and Longitude of the principal head-lands of Cornwall, viz. the Lizherd point and the Land's end, do not exactly agree.

The Lizherd is reckon'd by

	Latitude.		Longitude from London.
Dr. Halley - - - - -	49° 55 ^m		5° 30 ^m
Martin - - - - -	49° 45 ^m		5° 36 ^m
Chart of Mount's Bay "	49° 53 ^m	30 ^{''}	5° 26 ^m
Renshaw ° - - - - -	49° 47 ^m	36 ^{''}	5° 36 ^m

The Land's End is reckon'd by

Dr. Halley - - - - -	50° 5 ^m		6° 7 ^m
Martin - - - - -	49° 56 ^m		6° 6 ^m
Chart of Mount's Bay	49° 59 ^m	30 ^{''}	5° 55 ^m 30 ^{''}
Renshaw ° - - - - -	50° 0 ^m		5° 56 ^m

C H A P. II.

Of the Air, and Weather.

AS the Situation of Cornwall approaches so near to that of an Island, it must be subject to all the disadvantages as well as much rain. reap the benefits of an Island-situation. No Air is absolutely pure, or free from exhalations; Heat, whether it proceeds from the elemental fire of all bodies, or from the power of the Sun and Stars, is perpetually raising into the Atmosphere Steams of Earth and Water; and in proportion as either of those Elements prevail, the adjoining Air will be suitably replete with vapours; consequently in small Islands, and upon the Sea-coast, where the area of Water is superior to that of Land, the Air must be moister, (other circumstances being equal) than in great tracks of land, and the Weather in general more subject to rain^q. And so we find it indeed in Cornwall, where a dry Summer is a rare thing; and when other parts of England suffer by drought, Cornwall has seldom reason to complain: 'Tis true no rule with regard to Weather shall always

ⁿ Publish'd by Dion Williams, surveyor, and others.

^o Large Chart of the Chanel from the observations made in an actual survey, by Renshaw and others, about the year 1741.

^p By another Chart, said to be corrected by Dr. Halley, and published in 1721, the Lizherd is in 49—58, and the Land's end in 50—6^m. the

Longitude not noted. In the Dictionary of Arts, &c. published in 1754, the Lizherd is plac'd in Lat. 49—50. Long. 5°—47^m. all Arguments that this chief point of England's Chanel has never been decisively laid down.

^q For this reason the seasons in the Orcades are reckoned to be very rainy.

obtain in any one place ; and in the year 1752, which we may reckon among some of our moistest Summers throughout England, more Rain fell at London than at Plymouth, according to an estimate made at both places ; and in the Winter 1756, there were greater complaints of the excessive Rains in Essex and the parts about London, than in Cornwall ; however, in general it is otherwise : but our Rains in Cornwall are rather frequent than heavy and excessive ; and we have very seldom a day so thoroughly wet but that there is some intermission, nor so cloudy but that the Sun will find a time to shine ; the cause of which, I apprehend, is the hilly, narrow, ridge-like form of our County, over which the Winds make a quick, because they have a short passage, and leave not the clouds to hang long in one place, as they do where the ground is more champaign, and full of various hollows and trees to intercept and detain them.

Another reason why we have in Cornwall more Rain than in other parts of England, is, because, for three parts in four of the year, the Wind blows from the intermediate points of the West and the South, which Wind coming over a large tract of the Atlantic Ocean, and consequently fraught with much Wet, discharges its Moisture as soon as the current of Air, which supported the clouds, is diminished and broke by the Cliffs and Hills. It was an Observation, made by our Saviour¹, that the Western Winds brought Rain in Judea ; and it could not be otherwise, because of their passing over so large a tract of the Mediterranean. The South Wind, coming from the Coast of Africk, had the same effect in the Adriatick², and upon the Coast of Italy and Greece³.

- - - - Madidis Notus evolat alis,
Terribilem picea tectus caligine vultum ;
Barba gravis nimbis, canis fluit unda capillis,
Fronte sedent nebulæ, rorant pennæque sinusque.

The Eastern Winds, blowing in from the Euxine Sea upon the city of Constantinople, fill the Air with Mists and Fogs. In all these instances the frequent Rains are the consequences of Winds passing over a large tract of Water, and this may lead us to the reason why the Winds blow so much from the South West in Cornwall. Certain it is, that Winds do generally blow from the Sea⁴, of which the cause may be, that every current of Air which is produced on the Ocean, meeting with no promontories or mountains to restrain them, have their full range towards the opposite shores. Add to this, that the

¹ Luke xii. 54.

² Quo non arbiter Adriæ major. Hor. lib. i.
Ode iii.

³ Metam. lib. i. v. 262.

⁴ Dr. Shaw Trav. p. 218. observes, that at Algiers the Winds blow generally from the Sea, from the West by the North to the East.

reflection of the Sun-beams upon the land being far stronger, and making the Air warmer and less dense over the land, *cæteris paribus*, than over the sea, the streams of Air, which are set in motion by various causes on the surface of the sea, must necessarily tend towards the land. Now the greatest quantity of sea to which England, and more particularly the Western parts of it, is most exposed, is the Atlantic Ocean, lying to the South West of it, between the continents of Africa, Europe, and America; consequently from this quarter the Winds must most generally blow.

Being so near the Sea as we are in most parts of Cornwall, our Stormy blasts are more violent than in the inland parts of England, because, though those lands which are more remote from the Sea are for the generality much higher than those upon the Sea shore, yet the currents of Air, which we call Winds, are so broken by the hills in some places, and absorb'd by valleys and woods in others, that they lose their strength, and gradually proceed into a more temperate motion, or even a flat calm, before they reach the more inland situations; whereas, near the Sea, they come on with their full force, without being impeded or dissipated. Hence it is that the South West Winds, which blow so long with us, not only bring rain, but also hard gales^{*}; every wind that rises advancing to the land without any obstacle over so large a plane of water as the Atlantic ocean.

SECT. II
Storms
mischievous.

It may not be amiss here to say something of the Atmosphere in general, and to hint at the causes from which those currents of Air, which we call Winds, may possibly arise. The Atmosphere is a <sup>The Cause of
Winds fug-
gested.</sup> congeries of Air, fiery, terrene, and moist vapours; the Air is the fluid medium through which the light passes, in which Fire is detained, into which the vapours rise, and there float till they fall. The Air is seldom at rest, being variously agitated, condensed, or rarefied, by the vapours and fire intermixed. The fire may be either equally dispers'd and stagnant in the Atmosphere, so as to remain invisible, or collected in one place, and from various causes susceptible of inflammation, activity, and explosion. The vapours rise from Land and Sea, and are consequently of a mixed nature; the dry parts of as different a composition as the Earths and Minerals, and the moisture as differently impregnated as the Waters of the Sea, Lakes, Rivers, and Fountains. Vapours float also in particular sortments, and in quantities of different magnitude, according as heat operates, and promotes their separation and ascent into the

Air. In other words, vapours are either dense and heavy, or in a rarer state; now spacious combinations, now smaller and more contracted; differently shap'd, their surfaces either sloping or horizontal, concave at one time and convex at another. These unevennesses of the vapourous contents of the Atmosphere must dispose the spaces of Air which lie betwixt and on every side of them into equal irregularities; sometimes into narrow guts and straits, sometimes into wider and more extended chanels; now perhaps some hundreds of leagues long, and sometimes not a mile; here a tall column of Air depends, there it is compressed into a spreading oblate disk, all caused by the different sizes, shapes, and substance of the Clouds and Vapours, and making the Atmosphere somewhat like Earth which it invests, full, if I may so express myself, of fleeting mountains, hills, plains, valleys, straits, and expanses. This is the general form of the Atmosphere; and were it possible for the human eye to comprehend this extensive prospect, and to note the successive alterations made in the Air by repletion and vacuity, by heat and cold, we should be no more surprised to see such a multifarious fluid perpetually in motion, resisted, protruded, condensed, expanded, retarded, or accelerated, in its different parts, than we are to observe the various eddies, torrents, swift streams, and stiller pools of a large river. For instance, in the latter case, if we see the current strong and swift, we attribute the velocity to the narrowing or shelving chanel, or perhaps to the additional influx of extraordinary Rain or Snow; but if we find it impetuous and irresistible, we conclude the banks have given way, and the Water, struggling to descend, rushes to that place where there is least resistance. As these are the causes of direct streams and their different velocities, the opposition of little islands and projecting banks in a river are the causes of delayed and crooked currents. In like manner, the spaces between the floating vapours are so many chanels through which the Air passes, ever struggling to maintain an equilibrium, and tending to any space which is less replete in one part than in another. Wind is nothing more than Air in motion; rarefactions and vacuities in the Atmosphere are the immediate causes of this motion, and are produced frequently, we may say continually, by several different causes. The Sun, by concurrent circumstances in land, water, and vapour, lightens and disperses the Air from one place, and at one time, more than at another. Inflammable exhalations and their explosions shall warm and thin the Air in particular places. A cloud or portion of Vapour full of electrical matter, passing near a cloud or region of land more destitute of electrical matter, will shed streams of fire upon the less electric body, and thereby excite violent motions.

Great

Great falls of Rain and Dew shall make way for the Air to expand, become rarer, and cause an indraught of that which is heavier. Condensations of the Air in one place will sometimes produce rarity in another; a body of Vapours may intercept and obstruct the communication of the several airy parts of the Atmosphere, and consequently prevent an equilibrium. Now, where-ever the Air is thrown into a state of rarefaction, there a vacuity is produced, and the adjacent Air flows as Water to the breach of a dam, and the flood is either violent or not, as the space through which it passeth is shaped, lasting as the quantity of the fluid set in motion, and as the extent of the vacuity is, which is to be replenished. If the vacuity be spacious, the flow will be plentiful; (obstructions in the way being allowed for) if the chanel through which the influx runs be long, narrow, and funnel-like, the velocity will be great, and vice versa; but if a large quantity of condensed Air chances at this time to press forward towards this large vacuity, the motion of the Air will be impetuous, or what we call a Storm. If, on the other hand, the rarefactions in particular districts be gentle, and there is room for denser Air to succeed without violence, the motion also is gentle; and where no extraordinary rarefactions are produced, and the Vapours are equally dispersed, a Calm ensues. If the Vapours assume the shape of an oblate disk, overspreading as a canopy a wide extent, the weight and continuity of the incumbent Air is in this district for a time, and to a certain degree, suspended, the Mercury sinks in the Barometer, and at the same time the current of the Air above this disk shall go one way, towards any vacuity which shall create a fresh tendency, and the under current of Air, influenced by another rarefaction, shall go on in a different, perhaps opposite direction, there being no communication betwixt the currents above and below the disk of vapours, sufficient to determine them to one point. Thus again, by the fall or even the recess of a great body of vapours in one place out of our sight, the air over our heads before condens'd, and keeping the Mercury high, extends itself into the vacuity; the wind blows, as we say, and the Mercury falls in a serene sky to our surprize. By the rising of a like body of vapours, and accumulating the air of our horizon, the Mercury rises in a cloudy and even rainy sky. When the Wind is violent, the perpendicular pressure of the air is much lessened by the velocity of the horizontal process (as a wheel that runs swiftly makes not so deep an impression as when slowly moved) and the Mercury falls. When the air is fullest of vapours, the Mercury falls, the pressure of the atmosphere depending not only on the weight of the fluid, but on the agility, and elasticity of the column of air which is broken and intercepted by such a quantity of moisture floating between, condensing and

ready to fall. These and many other variations which might be mentioned, are the necessary result of meteors, vapours, and air intermixed in separate portions, and acting with reciprocal, but generally very different powers; however, between the Tropics these varieties are over-rul'd, and superceded by the incessant heat of the sun, which produces regular, or trade-winds: but to finish this excursion and return, I am not here to attempt a Theory of the regular and irregular Winds; let it suffice, that the causes of Winds in general, and their several velocities, may be very rationally attributed to the rise and fluctuation of vapours, the shape and size which their combinations assume in the firmament, and the different condensations and rarefactions of the air.

SECT. IV. The air of Cornwall must needs partake of the salts of the sea adjoining, in a great degree, and therefore corrodes iron in a very short time, and near the sea, more than in the inland parts; the bars and frames of windows, and every thing else made of iron, presently giving way to the salt spray, let them be painted ever so well. This saltiness of the air is also very unfavourable to scorbutic habits; the sea-vapour not being sufficiently corrected by a proper quantity of effluvia from the land. It is also very prejudicial to shrubs and trees; and near the sea shores, especially towards the West, whether mix'd with the North or South winds, will permit a tree to rise very little above it's shelter, which is very discouraging to all new plantations. Indeed there is reason to think, that vapours in general, rais'd from the land and dropping in rains, are much more nourishing to plants than those exhal'd from the sea. For vapours from the land are charg'd with the particles of the soil they rise from, and supply the plants and trees, wherever they fall, with a kindly juice, mix'd with fresh and new earth; and this is the reason that the more water is distill'd (that is, forc'd to deposit it's terrene fæces) the less it nourishes plants: now vapours rais'd from the sea can be no other than strain'd or distill'd salt water, and therefore cannot be so fit for vegetation, which is confirm'd also by this observation, that most trees thrive better at a little distance from the sea, than near it's brink.

This Sea-air is pernicious to plants in proportion to their tender, or robust nature, and the force with which it is driven upon them; for after a storm we usually find the young shoots of plants shrivell'd, according as they were more or less expos'd, and to the tast of a very pungent saltiness: the fibres are first bruised by the violent gusts of wind, and the salt air coming in quick succession, insinuates itself into the wound, scorches the sap vessels, and vegetation

vegetation is at a stand till the tone of the vessels is restored. Under shelters, and at a few miles distance from the sea, trees suffer less; but all, I think, in some degree, as they shew by leaning from the sea winds; so that without great industry in raising shelters, and great attention to the care and repair of them when rais'd, we are not likely to see our hills planted, nor hedge-rows of tall trees make a figure in Cornwall, as they do in some counties, though farther from the sun, because less exposed to the sea blasts.

Our winters in Cornwall are far milder than in any part of England: Myrtles, of whatever kind, are in no want of green-houses, and if now and then, through the severity of an extraordinary cold season, their upper shoots are killed by the frost, cut them off near to the ground, and they will sprout plentifully in the succeeding spring, and make as good plants as they were before. We have no showers of excessive large hail in Cornwall, as they have in the inland parts, and snow seldom lies more than three or four days, which is to be attributed partly to our sea-air, which yields not nitre and other sharp salts, in sufficient quantity to make our frosts and congelations in the atmosphere extreme and lasting, and partly, but in less degree, to our latitude, which is the southernmost of all England. However, when the winters are more than usually cold in other parts of the Island, Cornwall feels it in proportion to its climate and marine situation. In the year 1739, at Christmas began a most violent cold, after two or three days of blustering North East Winds: on the 29th of December it froze very hard, the next day it began to snow, and the windows of my little greenhouse being accidentally open, the Orange trees and Jessamines were killed to the very roots by the next morning; the extremity of the weather lasted a full month, and the snow lay in some corners of the fields full two months; but such winters are seldom known in Cornwall. In the year 1755, the Mercury in Farenheit's Thermometer was not under forty degrees. In the year 1756, not lower than thirty nine, which was December the thirty first, in hard frost.

As our winters are usually mild, our Spring for the same reason shews itself early in buds and blossoms, but I think its progress is not so quick as elsewhere; for as there is a languid kind of Spring throughout the winter, (chiefly, indeed, in the sunny southern lands) the spring season cannot be said to be so early in other counties as in Cornwall; but when the winter is over, and the Spring begins in other mediterranean counties, I apprehend, it makes much stronger efforts, and quicker advances, than with us; the repose of the winter,

winter, in such counties, imparting to vegetation a vigorous spring, unknown to the equable seasons of Cornwall. In short, the seasons with us in Cornwall, are like the Neap-tides, they neither ebb nor flow with any great energy : the heat of the atmosphere neither retires so far from us in winter, nor advances to that height in summer, as it does in the more inland counties : consequently, our summers, though we lie so far to the south, are not hot; for there is always a sea breeze flowing towards the land, and the air of the sea is never so hot, *cæteris paribus*, as the air of the land; because the strong reflection of the sun beams from the land almost doubles the heat; the sun beams are also detain'd in the vales and hollows, in the midland parts, (circumstances not common to the sea and sea, coasts) which have the same effect upon the air (though in a less degree) as concave mirrors, always heating, though not always burning: It is much hotter therefore in the midland parts of England, during the summer, than in Cornwall; this may make their harvests earlier, and their fruits generally of a higher relish than with us, (in equal circumstances, I mean, as to drought and moisture, sterility and fatness) but the air is more temperate and less sultry with us, the sea air equally asswaging the heats of summer, and moderating the winter colds.

*Est ubi plus tepeant Hyemes? ubi gratior aura
Leniat et rabiem Canis, et momenta Leonis?*

HOR. Epist. lib. i.

SECT. VI.
Meteors and
Lightning.

As there are so many mines in Cornwall, and most of them yield sulphur, vitriol, mundic, and goffan^x, they cannot but affect the air with their steams in proportion to the quantity yielded by the mine, and the facility with which their parts separate and ascend into the Atmosphere. These mineral vapours ascend so copiously out of some of our Lodes or veins of metal, and consist of such inflammable parts as to take fire, and appear in flame over the Lodes from which they rise, and it is a common opinion among Tinners, especially those of more than ordinary speculation, that where little flames of light are seen in the night time, there a prosperous Lode lies underneath, but indeed the lights which are seen in the night are much oftner ignes fatui^y, and have nothing to inform us of, but that being deserted by the sun that rais'd them, their own weight confines them to their low situation, where they yield their electrical fire, and will always do so, whenever proper motion and materials concur.

^x An iron, ochreous, stony clay.

^y Called by the Cornish, Jack with the Lanthorn.

On

On the 20th of December 1752, about eight in the morning, the sky was on a sudden overcast with dark-red angry clouds; the wind very boisterous; at intervals a blue sky, then large clouds with cold showers: about a quarter before twelve neither rain nor wind, but sunshine; some flying thin clouds were observed to join, and one of the most shocking peals of Thunder ensued. The Lightning fell with greatest violence upon a hill called Moelfra, in the parish of Maddern, where it pierced banks like a dart, furrowed the ground as if it had been a plough-share, cut off flat turves, burst rocks, split them into shivers, fell on some particular spots of the rocks, and splintered them as if musket balls: it rooted up some stones, and made its way clear under others, shewing the traces of its passage on both sides. The whole workings of the Lightning in this hill (than which there is no higher land betwixt the North and South Sea) were in length about a furlong from East to West; and there was a smoke seen in this part of the hill, as if several Muskets had been discharged: at the Thunder, the sheep dispersed and ran to and fro, as if pursued by a pack of dogs. At Trythâl, a village without tree or hill near it, about a mile and half South West of Moelfra, this clap of Thunder was so violent that nothing was remembered equal to it; but the effects of what followed in a few minutes were still more dreadful, and of the most deplorable kind. “ Thomas Olivey^z, a farmer of good substance and repute, was returned from the field about a quarter before noon, and had all his family round him in the kitchen, except his daughter, who was in the hall. There was a brass pan over the fire in the kitchen chimney nearly full of boiling water; the farmer was sitting by the fire, his wife on a bench before it, their only son, 23 years of age, was standing at the window; the farmer finding the Thunder and Lightning before-mentioned so violent that the back-door of his kitchen, facing the North, quivered, called to his son, and desired him not to stand so near the window, least the Lightning should hurt his Eyes, upon which the young man removed from the window backwards into the corner of the room, and sat down, as he thought, in a place of greater security; for this, the apprentice boy laughing at him, was chid by his master, and, luckily for him, sent out of the room to take care of something without doors. Immediately the Lightning came from the W. N. W. and falling upon the stack of the kitchen chimney, which was about four foot square, and as much in height, of hewn stone, carried it clear off from the house, and threw it into a pool of water 20 feet distant. In the chamber over the kitchen there was a little closet boarded in, which stood just under the top

^z These circumstances were laid before the Royal Society by the author, and are published in the Transactions of the year 1753.

of the chimney where the Lightning first fell ; all the boards were broken to pieces, the bedstead and the timbers of the roof shattered ; of the chamber partition two planks were forced, a large pres for holding cloaths thrown down, and the south windows of the chamber floor (except one casement) all broken and blown out. From the top of the chimney and the chamber floor it descended vertically into the kitchen below, where the family was. The farmer saw no Lightning, nor heard any Thunder, being struck senseless with the first flash, and thrown into the middle of the kitchen, where he continued senseless for a quarter of an hour. As soon as he came to himself, he asked, Who struck him ? but had not the use of his arms, and felt an aching pain shooting, as he described it, into his bones ; and a brand-iron, which hung in the chimney, being thrown down into the pan of water, had dashed the boiling water upon him to that degree, that his life was in extreme danger for more than a fortnight after. Mrs. Olivey was struck down upon the hearth ; both her shoes, though buckled on as usual, were struck off her feet, but her feet not hurt ; and being neither burnt nor senseless, she was able to cry out for help, but could not move ; for she had no use of her under limbs for a day and half : the farmer's brother was at the end of a long table in the same room, and was only flung against the wall about three feet distant, and not hurt. Mrs. Olivey's sister was near the back-door ; a part of this door was started and beaten in, she was struck senseless, and thrown twelve feet off against a settle, which stood contiguous to the south wall of the house. The farmer's son had seated himself according to his father's directions, but unhappily in the very course of the fiercest Ligthning ; his coat and waistcoats (for he had two on) were torn into shreds, so that it was difficult to distinguish where the pieces had formerly joined ; his shirt had a rent two feet long down the back, and was singed ; his left shoe torn from his foot ; and the little toe of that foot so near cut off, that it hung but by a bit of skin ; and he was quite dead : but though reduced to this lamentable condition, as to his exterior, he was not moved from his seat, nor his face at all changed. His dog was lying at his feet, dead likewise ; but not moved from his place.

The farmer's daughter received the shock in the hall, was struck senseless, but revived soon ; felt a trembling all over, her feet tickling, partly benumbed, and stiff, as if sleeping ; but perceiving in the room a cloud of smoke, and hearing her mother cry, she made haste into the kitchen, which she found full of smoke, stinking like brimstone. The Lightning had left a mark quite across the clavel of the kitchen chimney, about half an inch wide, in an undulating direction, broke through the partitions of the under floor, thrown down

down the shelves, carried out all the south windows, forced up the stair-case, blown out the north window, but spared the clock, which stood close by it; and being somewhat spent when it reached the hall, carried out the windows, and moved not some Delft basons which were in the south window, forced the door of a beaufet at the end of the hall an inch and half inwards, and shook the eastern wall of the house throughout to the very foundation."

Though it might be sufficient here to relate the matters of fact in the order of time, place, and degree, as they happened, yet one cannot help admiring the different currents, motions, shapes, and desolations of this Lightning. The clouds over Moelfra hill and this village of Trythâl, a space of about a mile and half, were so much more charged with inflammable vapours than the other clouds, that here they broke both the first and second time, with superior violence, and the Thunder-claps were within a few minutes of one another, as being produced but by two portions of one and the same congeries of fire.

The general tendency of this Lightning was as the direction of the wind at that time; that is, from the North West Eastwardly; but where the principal explosions were (as at the hill and the house) many branches spread themselves off in all directions.

Nor were the shapes in which it operated less various than its motions; sometimes, as from its effects appeared, it was pointed as a dart, in some places edged as a scythe; now but one thin sheet or stream, then two or three, and afterwards one again; now it fell as several separate balls of fire; but upon the house, where the principal explosion was, as a large gush or torrent.

It was all fire, yet of different powers, according to the impregnation of its several portions: subtil and penetrating as the electrical fire, it shocked and permeated the human frame; some parts of it only scorched wood, never melted iron, which is the more common effect of the two; some tore the leather and cloaths, some cut and wounded, and some killed, without visible cut or puncture; other parts of this Lightning again, upon stone, wood, leather, cloaths, and flesh, only discoloured, rushed, and forced, with the power of infected air put into a violent fermentation.

All this happened in this place, and all in an instant; and altho' the cloaths were somewhat singed as well as torn, and the young man's skin round his waist was also scorched, yet from the general effects of this Lightning at the hill and village, I conclude, that it was rather swift and irresistibly piercing, than dissolvent and inflammatory.

This happened in the winter month of December, but the ravages of Lightning are not limited to a season.

On

On Tuesday, August 2, 1757, between one and two of the clock, as James Tillie, Esq; of Pentillie castle, in Cornwall, with his neighbours and servants, were lying aground in a boat on a sand-bank in the river Tamar, not half a mile from his own house, waiting the tide to throw a net for salmon, a sudden clap of Thunder broke over their heads. In a field adjoining the grass seemed on fire and the whole field in a flame, and a fire-ball was observed just to pass over the hedge at the top of a very steep wood which hangs over the Tamar. The fire-ball fell on the boat; and passing from the South-West in a direct line from the larboard bow to the stern, James Widear, Mr. Tillie's servant, in the bow, had a violent blow on his right shoulder and head; Mr. Samble, who sat next to him, was struck deaf for some time; Mr. Tillie sat next in the middle of the boat, and plainly perceived the fire-ball, about five inches diameter, somewhat sharp, and pointed in the fore-part, to pass by him at about three feet distance^a: he was violently struck on the back part of his head by the current of the air attending the ball; his eyes were shut, and he leaped from his seat about two or three feet high; and on the return of his senses, opening his eyes, was surprized to find himself standing; for before the shock he was sitting on the oar. The right side of his face continued very warm for two hours, and the corner of his hat was carried away, as if half of a small bullet had been shot through it. Robert Atkins, a servant of Mr. Tillie, was near the stern, with his face to the South-West, but not in the direct line of the fire-ball: he was struck speechless, thrown on his back upon the fishing-net, remained insensible for two or three hours afterwards, his face was black, as if the priming of a gun had been blown by accident over it; his left eye weak, and contracted for a fortnight after; with a great numbness in all his limbs, until a brisk circulation of the blood ensued, and then he had violent pains, which wore off slowly, leaving him weak and low, with complaints of frequent head-ach, but no visible mark of hurt. Mr. Pethen, a tenant of Mr. Tillie, was standing three feet from Atkins, upon the seat of the stern, with his face to the South West, and had scarce done speaking when the fire-ball fell on his left temple, and struck him dead into the river. He was immediately taken up by some of Mr. Tillie's servants on the shore. His periwig on fire, and smoaking in the stern of the boat, Mr. Tillie took up and extinguished: it had a hole burnt in it as large as a crown piece, and smelt strongly of sulphur. His hat was blown into the water, rent three or four inches long, the lining only ript: His cloaths were but little rent: on his hip there was a black scar about three or four inches long, and discoloured as if filled with

^a Letter from James Tillie, Esq; to the author.

~~colon;~~

gunpowder : his neck and left breast were soon after his death changed to a claret colour ; but where the fire-ball fell, it left no wound more visible than the puncture of a pin, neither did it discolour his temple ; but the third day the lower part of his face altered a little, and the other parts of his body became discoloured more and more, till his burial. All his cloaths smelt like gunpowder newly discharged. There were three persons standing on the adjoining sand ; one was violently struck on the head, the second had his eye finged, and the fire-ball fell between the legs of the third into the sand, from whence he only perceived a sudden warmth. The day had been showry, neither hot nor cold ; and the sun shone, though faintly, about ten minutes before the explosion. No one had his face turn'd towards the South-West but Mr. Pethen and R. Atkins.

Having mentioned the excesses to which the air of this County is SECT. VII.
subject, I cannot but observe, that, notwithstanding this, the air is Air healthy.
very healthy. Though we have frequent rains, the air is by no means rendered thereby less fit for respiration : it is not charged with the sluggish exhalations of bogs, marshes, or stagnating pools among thick woods ; nor do there many flat calms happen ; and when they do, they seldom continue for the space of a day ; for either the sea breezes interpose, or the numerous promontories^b, by opposing and collecting every current of air, promote a constant flow of wind one way or other round their extremities, so as that mists seldom rest long. Neither can the saltneſs of the air, nor the mineral exhalations, be ſaid to make the air fickly, as many instances of long life (as will appear in the following sheets) being to be found here as in any part of England, ſo happily do these ſeeming extremes correct and qualify one another, and by a mixture, of which we know not the limits and proportion, rectify and keep the air in a wholſome temperature.

The husbandmen and fishermen here have many signs of the SECT. VIII.
ensuing alterations of the weather, as thoſe, whose daily employ- Weather
ments are in the open air, have, by experience, learned in all places ; figns.
but one appeared new and singular to me. Saturday, August 15,
1752, the wind at West North West, the sky cloudy, the Mercury
moving upwards in the Barometer, about six in the evening, there
appeared in the North-East the frustum of a large rainbow ; all the
colours were very lively and distinct, and it was three times as wide
as the arch of an ordinary complete Rainbow, but no higher than it
was wide. They call it here in Cornwall a weather dog ; but in

^b So many, that they are thought to give the British name of Kernou, (signifying horns, or head-

lands) to this County, whence the more modern names of Cornwall, Cornubia, Cornugallia, &c.

the Cornish tongue, Lagas-ael ; that is, the weather's eye ; and pronounce it a certain sign of hard rain. Notwithstanding this, the Mercury fell only two tenths of an inch, and on Saturday night there was no rain. Sunday morning was dry, but not clear ; and about eleven it began to rain gently, about one, post merid. a flood of rain came on, and continued all Sunday night, and till ten the next morning.

SECT. IX. The conjunctions and oppositions of the Sun and Moon would Inconstant, as have a regular effect upon the Atmosphere of the Earth, and con- to Rain and sequently influence the wind and rain in a regular manner at peri- Wind. odical distances of time, if the Atmosphere was always in one fixed equal temperature. This we see plainly demonstrated in a thicker medium, by the regular influence of the Sun and moon upon the Ocean, where the tides rise and fall as the Moon is perpendicular or oblique, in its meridian or decline, and vary generally, though not exactly, according as the Sun and Moon act in concert or opposition ; but the Atmosphere is a much more mixed and complicated body, as well as much easier disturb'd, than the waters ; and in proportion as the several airy, aqueous, saline, or sulphureous exhalations prevail at any time, and in any place, the alterations which would otherwise regularly follow the positions of the Sun, Moon, and Earth, are suspended and controuled, and oftentimes totally prevented, and the quite contrary effect produced, by the more powerful, though fluctuating and uncertain, combinations of the parts of the Atmosphere.

The weather is therefore inconstant every-where, but in some places more so than in others. In hot countries it is more inconstant, and the alterations more violent, *cæteris paribus*, than in cold. In the Torrid Zone there are more tornadoes and hurricanes than in the Temperate Zone ; more inconstancy of weather again in the temperate than within and near the Polar Circle, where by reason that the Air is more condensed, and the Atmosphere suffers less alteration from the Sun's influence and the variety of vapours that attend it, the weather is much more uniform, clear, and equable, than in warmer climates. In Cornwall it may be reckoned in general as unsettled and various, as to wind and rain, as any-where in Britain, such sudden transitions there are from wet to dry, and from calm to tempest. One of the greatest variations which I have observed in the Mercury of the Barometer, was April 3, 1753 ; when, from Tuesday nine o'clock in the evening, to Wednesday ten o'clock in the morning, the Mercury fell $\frac{77}{100}$ parts of an inch, the Mercury resting at $28 \frac{3}{100}$, which is the lowest I have ever yet noted. It then blew a storm, with some showers of hail and rain ; and

and the vacuity of the Atmosphere, which occasioned this great subsidence of the Mercury, drawing after it a gust of air, the Mercury began to rise at one o' clock, post merid. and by ten at night was risen $\frac{58}{100}$ parts of an inch. During all this month the greatest variation at London in one day was but $\frac{40}{100}$ parts of an inch. A more surprising variation still happened on Wednesday, February 18, 1756: the morning very dark, Wind at North East, it snowed hard, and the wind blew a hurricane all the forenoon; my Diagonal Barometer continued at 28---84: next morning, the Wind at North, cold Hail, and then Sunshine, the Mercury was risen to 29---84; a very extraordinary rise for so short a time. At Liskerd about 60 miles to the Eastward of my house, from Wednesday February 18, 1756, 12 at noon, to Thursday 19 at noon, (viz. in 24 hours) the quicksilver rose one inch $\frac{13}{100}$ ^e. By this violent and sudden alteration in the Mercury it appears that the Atmosphere at these times must have been greatly agitated, and proceeded over the earth in vast waves; low, deep, and hollow, when the Mercury fell; lofty and mountainous afterwards, which occasioned as sudden a rise. This desultory state of the Atmosphere will also account for and confirm the common observation, that when the Mercury rises or falls quick, it is a certain sign of a short continuance of fair or foul weather: the fluids over our head are agitated in like manner as those of the ocean, but, as being a thinner medium, much sooner, easier, and by less force; and when the column of air over any place is suddenly and greatly encreased, that height must be quickly followed by a depression of the next succeeding portion of the Atmosphere, as surely as an elevated wave of the sea leaves a hollow to come after it: but when the Mercury rises or falls gradually, or continues stationary, then the Atmosphere being of a plain surface, little agitated, the column of air is nearly the same, and the weather is likely to continue for some time.

But though our weather, as to wind and rain, is so inconstant, yet as to heat and cold it is much more constant and settled than in the Eastern parts of England. Six several days in July, 1756, Farenheit's Mercurial Thermometer altered only one degree; two degrees nine days; three degrees seven days; four degrees three days; five degrees one day; and on five days there was no variation: but the Thermometer at London on two days altered one degree; two degrees on two days; three degrees on six days; four degrees on four days; five degrees on three days; six degrees

^e At London, if I am rightly informed, the rise was still more precipitate; the Barometer at the

Royal Society was on this Wednesday but fourteen hours rising one full inch.

on four days; seven degrees on five days; eight degrees on three days; nine degrees on one day; and one day it varied twelve degrees; viz.^a on the 22d of July: whereas on the same day it varied with me at Ludgvan but four degrees.

From the following table it will appear how much greater the variation of the Thermometer was at London than in Cornwall in the Summer, Autumn, and spring months, 1756 and 1757.

Variation of Farenheit's Mercurial Thermometer.

J U L Y 1756.				O C T O B E R 1756.				M A R C H 1757.			
In Cornwall.		In London.		In Cornwall.		In London.		In Cornwall.		In London.	
Degrees.	Days.	Degrees.	Days.	Degrees.	Days.	Degrees.	Days.	Degrees.	Days.	Degrees.	Days.
1	6	1	2	1	13	1	4	1	10	1	1
2	9	2	2	2	7	2	9	2	3	2	5
3	7	3	6	2	1	3	4	3	8	3	7
4	3	4	4	3	5	4	7	4	1	4	9
5	1	5	3	4	1	5	3	No variation	4	5	2
No variation 5		It altered.		No variation 4		It altered.		Higher in the Morning than at Night		It altered.	
	6				4				6		
	7				5				7		
	8				3				10		2
	9				1				0		1
	12				1						

The several degrees multiplied by the days will shew the difference. The reason of this greater variation of the Thermometer at London than in Cornwall is, chiefly, that the reflection of the sun-beams from a tract of land which has no large portion of the sea near it, makes it hotter at noon, and consequently the quicksilver rises higher than in Cornwall and in small islands, where there being a greater quantity of sea than of land, they want this additional heat and the quicksilver rises but a small matter; on the other hand the ceasing of this reflection in the inland-parts by the coming on of night, makes the Mercury sink in proportion; whereas in Cornwall, as the noon is not hot, the night varies not so much from the day, especially if the day be cloudy, when I find the Mercury at eight or nine o'clock p. m. almost as high as at noon, and the general difference at a medium, but one degree. The greatest difference in the height of the Mercury in Cornwall therefore, is between eight at night and four or five in the morning.

It may not be amiss here to observe how different the weather is now and then in climates not very distant: In the year 1751 we had a very rainy summer throughout England, scarce two days passing without frequent showers, and the Mercury in the Barometer very unsettled; in three days space varying generally $\frac{30}{100}$ parts of an inch. At the same time, in Italy prevailed an extraordinary drought; the accounts from Parma, dated July 17, running thus, "Publick prayers are still continued in all our

^a According to the account published at London of Mr. Ayscough's observations.

churches,

churches, in order to implore the Almighty to send down some showers of rain to refresh the fruits of the earth, which are already greatly damaged by the excessive drought which has raged here for a considerable time :" which shews that as inconstant as the weather and winds may be, the Atmosphere may be overloaded with moisture in one place, and greatly destitute for some months together in another place not very distant ; the plenty of rain here, it seems, had made a scarcity in Italy, and there cannot be a redundancy in one climate without occasioning the reverse in another : one determined quantity of moisture is indeed allotted by the great distributor of all things, who created his blessings by scale and measure ; but he delivers them out to us in plenty or scarcity, as it seems good to him either to prosper or correct us ; parsimonious and retentive as it may appear to us at first sight, to one part, over-liberal to another, but really just, gracious, and invariably beneficent to the whole.

C H A P. III.

Of Waters in general, and those of Cornwall in particular.

WA T E R however attenuated or disguised, is Water still, SECT. I. and it's particles unalterable though of the most moveable kind ; consequently, all quantities of this liquor, from the ocean down to the most rarefied vapour, are equally Water, and will require some notice to be taken of them in this place. Water therefore includes Vapour, Dew, Damps, Springs, Rain, Brook, River, Lake, and Sea.

As Air is necessary every minute to give spring and motion to SECT. II. the solids as well as fluids of all bodies, so is Water to renew the Water in general. liquids, which are perpetually shifting their place, and without constant supplies would leave the solids they depart from, meer dust. Water is therefore dispersed throughout the universe, in order to maintain the coherence of all bodies, supply waste, and prevent the ascendency of Fire, which without Water to oppose and qualify it, would parch and reduce all bodies to a calx, to ashes, or cinders.

Particles of Water are generally allowed to be round as to figure. This figure indeed is not to be demonstrated, but is inferred from its fluidity. Allowing then the figure of watry particles to be round, fluidity must be an essential property of all quantities and assemblages of these particles^e; for take any mas of round bodies,

^e Not the effect of fire as some philosophers have lately held.

(bullets for instance, pebbles, or the like) they will not cohere nor rest by one the other without force, but will flow on every side, till they meet with such resistance from external bodies, or their internal gravitation as shall prevent farther motion.

The particles of Water are unalterable; for, passing into so many bodies, and through such alternate extremes of heat and cold, if they had not constantly preserv'd their essential properties, moisture, since the beginning of the world, must have sensibly diminished; but seeing no such deficiency appears, and that springs, rains, and rivers are as abundant now as they anciently were (as by the observations on the rising of the Nile for many ages, among other reasons may appear) we are to conclude, that though Waters may be transplanted, they can neither be transmuted nor destroyed, and whereever removed, will make their appearance again when at liberty, in the same liquid state as they were in before.

The particles of Water are exceedingly small, for they may be so divided from each other, as that one square inch of common Water shall when rarefied, fill a space which will contain 14000 square inches^f; and it is computed that at least 13000 particles of Water may be held on the point of a needle^g; by which it appears, that what we call Water is an assemblage of a great number of small transparent globules, which are composed again of an infinite number of smaller particles or atoms of this elementary liquor. The uses and application of these general observations will soon occur.

Pure Water, without any mixture of earth, mineral, salt, or oil, we know not any in it's natural state, but it is in some parts purer than in others, and best, where it is found sufficient in quantity, and in greatest degree of purity.

With Water in general few counties are supplied so well as Cornwall, and yet fewer are the places where Water is more precious; the most impure and infected Waters being of great use for mills, engines, and cleansing the ores, and oftentimes rented at an exorbitant price. I have known twenty pounds a month given annually for one Water-course to drive an Engine-wheel, three years following; nay I am assured that fifty pounds a month have been given for the same purpose. These Water-courses are usually not above the size of an ordinary Mill-stream.

SECT. III. The parts of Water being so small and moveable, are easily separated one from another; and when they are so divided into small parcels as to become about 800 times lighter than common Water, they are at least as light as the air, and will, by every suc-

^f Muffchenb. pag. 738.

^g Nieuwentyt's Exper. Muffchenbr. p. 425.

cessive

cessive degree of separation, rise in the air in proportion to their lightness, the heavier air forcing the rarefied fluid to ascend into the Atmosphere till it finds a place where it rests in equilibrium among bodies of equal lightness to itself. This separation or comminution (if I may so call it) of Water into small parcels, may be performed either by collision against harder and more compact bodies, or by heat. The first we often see performed at the bottom of Cascades, where the Water that falls but a few fathoms, shall rise in a mist from the bottom where it is broke; and there are instances of clouds rising from the fall of Waters which may be seen five miles off^h. Collision will therefore excite vapours; but that which is more constantly producing this effect in every part of the universe, is Heat; whether from the Sun, which is always busy this way, or from artificial ignition, or that generally invisible elemental fire which is distributed through all matter. It has been by many Naturalists imagined, that heat raises vapours by extending the air inclosed in the pores of Water, and forming gradually a thin film or bubble of Water of such dimensions that it becomes greatly lighter than the same space of common air, and therefore rises above it: but this supposition is not tenable; for it is observed, that steam will rise in the receiver of an air-pump, where, though there remains some air, there is not enough to constitute such a process. It may here also be added, that earth and stones and metals may be raised into the Atmosphere, although their parts will not form bubbles as those of Water will. As this too generally allowed supposition is not to be supported when strictly examined, so neither is it at all necessary for us to consider in this case any other than the divisibility of Water, and the insinuating and dispersive qualities of fire; both evident in their effects. Fire, we see, separates more or less the parts of all bodies, whether fluid or solid, and makes them rise in the air: separation therefore is all that needs be supposed; and fire does no more to Water, than to all other bodies under its power: it separates it into such small portions, that the air is more ponderous than the steam, and of consequence remains nearer to the earth by its superior gravitation.

The parts of vapour are not all equally small, but small according to the degree of heat which rarifies them: they will rise in air, when rarified only 800 times; but they will rise quicker, (that is, with greater force) and higher, according to all the intermediate degrees of rarefaction, from 800 to 1400. Vapour greatly heated becomes so elastick that it will move vast weights; nay, it appears from experiment, that, when it is sufficiently rarified, it exceeds

^h The fall of Waters at Niagara in North America, and that of the river Velino in Italy, Muffchenbr. page 740.

the force of gunpowder¹ by the proportion at least of two to one. Rarefied vapour is of great use in Cornwall, and enables the miners to get rid of the Water of their deepest works by means of the fire-engine (as will be more particularly set forth in the sequel); an engine which acts more forcibly and constantly than any other Hydraulic machine hitherto invented.

SECT. IV. Damps. Water having been now considered in its most minute state (that of rarefied vapour) it must next be observed, that damps rising in our mines oftentimes so affect the miner that he cannot work, neither will candles burn. This generally happens when the workings are got to any great distance from the communication with the open air; and the reason is this: Vapours are thrown up by the heat of that fire which all bodies more or less contain in themselves or receive from other bodies; but in a deep mine they cannot rise much above the surface of the ground, because there is not air enough in the passes of the mine to buoy them up, consequently they are too moist for respiration, because they want a sufficient mixture of air; neither can they yield that inflammable nourishment to the candle which common air by its own elasticity, and its mixtures of oil, earth, and sulphur, at all times does afford; so that the flame is stifled, being equally unable to throw off the parts which are burnt, and to promote a fresh succession of oily parts requisite to feed the fire. These sluggish damps are greater or less obstructions to the workmen, according to the moisture or drought of the ground: they have nothing pernicious, generally speaking, in their own nature; they rest near the bottom, and incommoder merely for want of an active air to disspell and raise them higher. Sometimes indeed these damps are infected with mudiic, and are then very unwholsome, creating nauseatings in the stomach, and in a few weeks making the visage sickly and wan; but I never yet heard of any damps in our Cornish mines so venomous as to be immediately fatal; the reason of which may be this, that most of our mines yield a current of Water in the bottom; this stirs and carries off the damps, and prevents their stagnating into a thickness which clogs and stops all vital motion. In order to admit the air, a pipe or funnel of framed timber, about nine inches square, is usually fixed, and reaches from the top to the bottom of the mine; and when the damps are thick and stubborn, the air is assisted in its descent by a bellows applied to the pipe. But this is a very slow and insufficient remedy where any dangerous damps are apprehended. Much more effectual it is, according to a modern author^k, to throw from you as far as possible

¹ Muffchenbr. p. 429. Sect. 873.

^k Letter to Mr. Hoofon, author of the Miner's Dictionary.

into

into the suspected or tainted pit, two quarts of spiritus urinosus volatilis, which will occasion so great a rarefaction as to overpower the poisonous vapours, and for a long time supply the want of air; the miner taking care not to venture into the pit till twelve hours after the infusion. Dr. Plot's proposal¹ is more easily executed. He advises, that one peck of unflaked lime may be thrown into such suspected place, which flaking in the Water, and fuming out at the top, will so effectually dispel all poisonous vapours in a little time, that there will be no further danger. These may serve for temporary expedients, but the most effectual, though expensive remedy is by a fresh shaft^m, to open a communication betwixt the drift and the common air.

The Dews in Cornwall are not remarkably noxious to either SECT. V.
herbs or animals, which I attribute to our having no long calms, Dews.

Springs may be divided into simple and mineral. Simple Spring- SECT. VI.
Water may be considered either as superficial or subterraneous. Springs and
By the superficial, I mean those Springs which rise out of, or their Origine.
issue from, the surface of the earth; by the subterraneous, those
which have their channels deeper, and their courses longer under-
ground. That superficial Springs are the effects of rain and dews,
cannot well be disputed, when we see their encrease and decrease,
according as the season proves wet or otherwise; but whence the
subterraneous, and those which feel no alteration from the seasons
derive their origin, has employed the enquiries of the curious, and
hitherto divided their sentiments. Some think them owing to sub-
terraneous heat; and no one labours more strenuously for this op-
inion, than the learned Morton, in his Natural History of North-
amptonshire, who has not only adopted what others have produced
for the better confirmation of this hypothesis, but has produced
several thermometrical experiments of his own, in order to establish
it. He derives Springs (constant Springs more especially) from
vapours thrown up by subterraneous heatⁿ, and thinks his observa-
tions manifestly shew how the Water of such Springs is supplied.
His arguments are drawn from the heat people feel at their first
entering the pit or well, which heat encreases manifestly as they
descend. "That wells in sand are hotter than any other of like
depth; and that the next degree of heat in wells, is in those cut
into a rock: That the faintings which seize the workmen, are

¹ Oxf. page 63.

^m The pit by which we descend into mines we
call a shaft.

ⁿ Northamptonshire, page 296.

^o Ib. 297.

owing merely to the greatness of the heat, and the thickness of the vapour in those wells, and not to a sulphureous or mineral halitus: That it is this thick vapour which extinguishes lights; and that the tepid stream is visible in frosty weather^p: That it is from this underground heat that the Water of our Rock-Springs is never frozen: That we meet with the like warm watery vapour in Caves as well as in Wells^q. To support this Hypothesis, he next produces his diary of the Thermometer suspended on different days for different spaces of time at different depths, and notes how much the Spirit in the Thermometer did rise by the warmth of his Well, above what it was in the open air before he let it down. But, with great submission, nothing certain can be concluded from these experiments in favour of the Hypothesis here espoused.

That it is warmer under-ground than it is above, especially in the colder months of the year, in which all Morton's experiments were made^r; and that at a great depth there is a greater difference, other circumstances being equal, betwixt the air underneath and that above, than immediately or but a few feet under the surface, must be agreed; but the question will remain to be decided, What this difference is owing to? The Atmosphere is a congeries of many bodies, air, sulphur, nitre, salt, earth, and fire, and capable of being chilled or heated by the different dispersion or combination of its own usual contents, as well as by the different influences of the celestial bodies. The air therefore is subject to great alterations of heat and cold; but where the air of the Atmosphere cannot reach, a more even temperature prevails, and the cold of the common air shall not affect the air of places with which it has not a free communication any more than the heat: this is evident in passing from the open air into a close room; and in a mine or well, where the air is less agitated by the wind, and not so mixed with the exhalations which occasioned cold and frost as the air above, it is impossible but it must be warmer for the generality, than it is upon the surface of the earth; and this is all that Morton's experiments prove. The ingenious and accurate Dr. Hales having placed six Thermometers, one above ground, and the rest "with their balls immersed in the earth, from two to 24 inches, at different depths, when the frost of the winter 1724 was so intense as to freeze the surface of the stagnant Water near an inch thick, found that the Spirit in the Thermometer, which was exposed to the open air, was fallen four degrees below the freezing point; the Spirit of that whose ball was two inches under-ground, was four degrees above the freezing point; the third, fourth, and fifth Thermometers, were pro-

^p Northamptonshire, pag. 298.

^q Ibid. pag. 298.

^r Ib. page 300.

^s From December 9, to March 10.

portionably rais'd, as they were deeper, to the sixth Thermometer, which, being two feet under-ground, the Spirit was ten degrees above the freezing point." *Veget. Stat.* p. 348. Now what are we to ascribe these different degrees of warmth unto? To subterraneous fires, operating so uniformly within two feet of the surface? No, certainly; but to the coldness of the air above, and to the incre equal temperature of the earth beneath, into which the cold of the air pierces less and less, in proportion to its distance from the surface, till at last the variations of the air have no effect at all. The truth is, fire is distributed in every part of our globe; and in the bowels of the earth, it is not subject to the checks and resistance of cold, so much as it is near the surface; hence arises a sensible difference; and it is warmer where this fire has liberty to act, than where it is controuled and repelled by fresh and cold air. But this superiour heat below cannot be a cause of sufficient power to produce the effect now in question; I mean, the Origin of Springs: this universal fire, whilst it remains dispersed in that harmles equilibrium to which Providence has graciously destined it, is weak and feeble, and its power to evaporate Water, even under-ground, must be too small and inconsiderable to give rise to all constant Springs. If there were such a subterraneous central fire as some learned men[†] have fancy'd, constantly exerting itself, and acting with a force gradually greater as it is nearer to the centre of the earth, this would be a caufe sufficient, and equal to the effect; but that there is any such fire does by no means appear; neither is it conceivable that any such fire can subsist without preying upon, and perpetually consuming, the vitals of the earth. If there was any such fire, the deeper we descend in mines the hotter we should feel it, the heat increasing by equal degrees the nearer we approach the supposed region of fire; but no such regular increase was found by the sedulous experiments of Morton. In the second experiment[‡], Feb. 16, at 9, a. m. the Thermometer standing low, viz. at five degrees below hard frost in the open air, when suspended for the space of one hour in a Well, at the depth of 25 feet, it rose 14. degrees. Feb. 27, 9 a. m. standing at two degrees below hard frost in the air, when suspended at the depth of forty feet, it rose ten degrees in les than half an hour; and Feb. 24, 1703, (See the ninth Experiment) standing at half a degree below hard frost, it rose sixteen degrees in a quarter of an hour, when suspended at forty feet; and when at hard frost, December 13, 1704, it rose sixteen degrees in a quarter of an hour, when suspended at twenty-three feet two inches (Experiment XII.): hence it appears, that when the spirit

[†] Woodward Nat. Hist. page 120.

[‡] Ib. p. 300.

was low, and the common air was very cold, the spirit rose much at several depths in the well; but when the Spirit of the Thermometer stood higher in the common air, the alteration was less: for Feb. 25, 1702, (Experiment III.) when the Thermometer stood two degrees below just freezing, it rose but five degrees, when suspended at twenty-one feet, for half an hour; and March 10, 1702, (Experiment 8.) the Thermometer standing at two degrees below just freezing, it rose but seven degrees though suspended at sixty feet for an hour; by which it is only plain, that the colder the Atmosphere, the greater is the difference between that and the more even temperature of the air below in the well, and the Thermometer rises higher, but not in any given proportion to the depth; so that what is here advanc'd cannot confirm the hypothesis now in question. That vapour, or moist steam, rises from all waters, and is indeed dispersed more or less in all places, not only in places open to the Atmosphere, but in the closest rooms and the deepest cells of the earth, is certainly true: Water will easily fly off in evaporation, sometimes imperceptibly, oftentimes, and in cold weather more especially, visible, as being condensed into larger globules by the ambient cold; and where there are subterraneous heats occasioned by the fermentation of Pyrites, Sulphur, Salt, and such mineral promoters of warmth, there this evaporation is copious and extraordinary, but still not equal to the effect, to the plenteous streams, and even immediate rivers which proceed at once from the bowels of the earth in some places; neither is there reason to suppose such subterraneous heats every where and at all times, nothing being more uncertain and unequal, than the distribution of such igniting mineral mixtures. 'Tis reasonable then to conclude, that the subterraneous heats which either result from the fermentations of mineral mixtures, or from the equal distribution of fire through all matter, are not sufficient where they are, nor constantly enough found in any place, to supply perennial springs. The groundless fancy of a central fire, and that mountains are alembicks in which the vapours are collected and distilled down their sides, is too chimerical to need confutation.-----Again, That perennial springs do owe their rise to rains and dews is disputed, and thought unlikely, because they do not seem to be at all affected by the excess or deficiency of either, let us consider therefore the nature of fluids and the texture of the earth together, and see whether perennial springs may not principally be owing to the waters of the Atmosphere although neither increas'd by heavy rains, nor sensibly diminished by great droughts.

The earth must not be looked upon as an absolute dry mass exhibiting here and there its wonders in pouring forth a spring

or

or fountain where there was no water before; the earth is porous in all its parts, full of chinks and ducts in most places, and opens into wide subterraneous caverns in others: Water is perpetually falling and insinuating itself by its own gravitation and fluidity into the hollows it meets with, or raised from lower into higher positions attracted by salts or sands, or transpired in vapour, so that sink as deep as we will, we find water either at rest in natural cavities, or circulating from higher into lower channels, sometimes in large currents, oftner in small threads and rills, but in some shape or other every where coasting through the veins of rock or clay, till it meets with such resistance from the strata that it is forc'd out through the soil into the open air. This is the general state of the earth, and to continue this moisture (without which the earth must soon become a dry sapless crust) fresh supplies are perpetually descending from rains and dews, and soaking into the earth from lakes, morasses, rivers, and brooks; where the passages are free and open, the descent is quick, and the increase of springs easily to be perceived, but where the chink and clefts of the rocky strata are close, or a large horizontal, impenetrable rock interposes, or where the fallen moisture is forced by any other obstacle to take a large round before it can supply any constant spring, there present sudden rain can have no visible effect. If the ducts which collect and convey these waters to their apertures are long, serpentine, and many, the spring shews no want of moisture in times of drought, because of the many ducts which serve it, nor any increase after heavy rains, because the channels of its nourishment are long, winding, and require time to reach the fountain head. Again, if perennial springs derive their water (as may often be the case) from large caverns which also have their supplies from rain, by ducts of a determined number and certain dimensions, which are neither contracted nor dilated, then will the stream be one certain equable quantity, let the season be ever so wet and rainy. If the season be extremely dry these caverns are capable of supplying the perennial springs to which they give rise, till fresh supplies from rain, or dew, or bog arrive, which must generally be the case before the caverns are exhausted. From this short view of the internal structure of the earth, it appears that there is nothing surprising in springs being perennial, they are nothing more than a collection of little rills of water, (as rivers are a collection of brooks) which tending nearly one way are united at last, and break out into open air, and though they owe not their immediate rise to the waters of the Atmosphere, as the temporary occasional springs do, yet proceed from ducts and reservoirs fed by the moisture of the adjacent strata, which moisture primarily proceeds from snow, hail, dews, and rain, though more

slowly communicated, and distributed by greater quantities into some strata than into others.

SECT. VII.
Rain and
Clouds ne-
cessary.

Here I cannot but observe a great mistake in some ingenious writers of Natural History, who very undeservedly look upon rain, as a punishment inflicted upon mankind for the sins of the antediluvian world, imagining that there was no such thing before the flood, even nothing but serene skies, and plentiful dews. But it may be asked, Was there any sun, any ocean, rivers, herb, plant, or tree? If there were, there must have been rain, nay violent rain. Could dews supply that moisture which the sun exhaled? What would become of Egypt where there is little or no rain, if it were not for something more than dew; if it were not for the river Nile? and whence comes the increase of their Nile, to which they owe the plenty of their grounds, but from the periodical Rains of Ethiopia? and what is the misery of that otherwise fertile and delightful country, but their want of Rain? Is not all vegetation at a stand, even in an English climate, after a long drought, notwithstanding the summer dews are then most frequent? How much greater still is the heat and drought betwixt the tropics? and how much more necessary the Rain in such hot countries? Dews are vapours exhaled by the Sun in its decline, and therefore rise but a little way into the Atmosphere, before the cold of the night arrests, condenses, and precipitates them: and what are these dews to all the vapours which the Sun in its strength must raise? What became of the day-vapours exhaled by the Sun; what hindred them from coalescing into drops, and those drops from falling, when they were become too heavy for the medium they swam in? and what hindred the Antediluvian seas and rivers from becoming dry but the returns of Rain? In short, if the Antediluvian world was without Rain, it was without the chief balance for the heat of the Sun, and that kindly moisture which the winds were chiefly designed to waft from place to place, and distribute by drops in such gentle parcels as might relieve and refresh both plants and animals; nay, not only gentle but violent Rains are as necessary to the orderly course of natural things as violent winds; they both tend to prevent stagnations in the Atmosphere and the Ocean, to disperse poisonous exhalations, and to distribute moisture and air where there was none before, or at least where there was much want.

Another error which these refined Naturalists were obliged to hold in consequence of the former, is, that the Antediluvian skies were without clouds, by which equally groundless fancy they stripped the poor Atmosphere and reduced it to a naked blank, forgetting nature in her gayest dress, nor considering that the richest streams of light, and

and the finest tints which the eye can see, or the pencil imitate, are borrowed from clouds.

By pure Water, I mean that which is most simple, tasteless, clear, SECT. VIII. and inodorous. Of this kind we have great quantities in all parts Of Wells of of Cornwall, but some Springs are more noted than others. pure Water.

The soil round Madern Well, in the parish of Madern, is black, ^{Maddern Well.} boggy, and light, but the stratum through which the Spring rises, is a grey moorstone gravel, called, by the Cornish, Grouan. Here people who labour under pains, aches, and stiffness of limbs, come and wash, and many cures are said to have been performed ^y, although the Water can only act by its cold and limpid nature, forasmuch as it has no perceptible mineral impregnation. Hither also upon much less justifiable errands come the uneasy, impatient, and superstitious, and by dropping pins or pebbles into the Water, and by shaking the ground round the Spring, so as to raise bubbles from the bottom, at a certain time of the year, Moon, and day, endeavour to settle such doubts and enquiries as will not let the idle and anxious rest. Here therefore they come, and, instead of allaying, deservedly feed their uneasiness; the supposed responses serving equally to increase the gloom of the melancholy, the suspicions of the jealous, and the passion of the enamoured. As great a piece of folly as this is, 'tis a very antient one. The Castalian Fountain, and many others among the Grecians, was supposed to be of a prophetic nature ^x. By dipping a fair mirror into a Well, the Patræans of Greece received, as they supposed, some notice of ensuing sickness or health, from the various figures pourtrayed upon the surface. In Laconia they cast into a pool, sacred to Juno, cakes of bread-corn; if they sunk, good was portended; if they swam, something dreadful was to ensue ^y. Sometimes they threw three stones into the Water, and formed their conclusions from the several turns they made in sinking ^z.

In the parish of Sancreed there is a Well whose Water rises in the ^{Euny Well.} same kind of soil as Madern Well; and as a witness of its having done remarkable cures, it has a chapel adjoining to it, dedicated to St. Euinus ^a; the ruins of which, consisting of much carved stone, bespeak it to have been formerly of no little note. The Water has the reputation of drying humours, as well as healing wounds and sores. It gives no perceptible evidence of any mineral impregnation; neither need it to produce the effects attributed to it, for certain it is, that the mere coldness of Water will work surprizing cures; wounds, sores, aches, disordered eyes, and the like, are often cured

^w See Camden's Britannia, page 13.

^x Clem. Protrept. Pett. Gr. Antigu. page 288.
vol. I.

^y Ib. 296.

^z Ib. 350.

^a Commonly called Chapel-Euny.

by that quality only ; the cold by bracing up the nerves and muscles, and strengthening the glands, promotes secretion and circulation, the two great ministers of health. In the northern kingdoms they are so sensible that all extraordinary defluxions of humours are owing to too great a relaxation of the parts, that they keep carefully the water of snow gathered in March, and apply it as a general remedy for most diseases : but the common people (of this as well as other countries) will not be contented to attribute the benefit they receive to ordinary means ; there must be something marvellous in all their cures. I happened luckily to be at this Well upon the last day of the year on which (according to the vulgar opinion) it exerts its principal and most salutary powers : two women were here who came from a neighbouring parish, and were busily employed in bathing a child : they both assured me, that people who had a mind to receive any benefit from St. Euny's Well, must come and wash upon the three first Wednesdays in May. But to leave folly to its own delusion, it is certainly very gracious in Providence to distribute a remedy for so many disorders in a quality so universally found as cold is in every unmixed Well-water.

Holy Well. Another Well of this plain kind, and of no little resort, is that called Holywell, about a mile and half to the North West of St. Cuthbert's Church, in a small sandy bay where there are several caves wrought into the cliff by the northern sea. In one of these caves, at the north-eastern point of the bay, at the foot of a high cliff is this Well. The entrance is low, but by the help of some steps cut into the rock, you ascend about fifteen feet perpendicular, where the water which distils from every part of the roof, is collected into a little basin, from whence proceeds a small rill about the bigness of a reed. As the Water percolates through the interstices of clay and stone, it brings down with it some of the finer parts of both, which form into seams and ridges correspondent to the fissures through which they proceed ; some short mammillary stalactites hang from the roof ; the floor of the rock, on which you tread, is covered with the same substance, and as the rock is shelving, the incrustations are so many wavy processses covering the unevenness of the rock. I mention these particulars the rather because such productions of the alabaster kind are extreamly scarce in Cornwall, and I have yet seen none worth notice but here. The water is much commended in fluxes, and disorder'd bowels. Upon trying this water, I found that with green tea it altered not it's colour ; with milk it curdled not ; so that it has neither steel nor alum in it's composition. I evaporated it to one half, no pellicle appeared, nor any crystallized shoots on it's cooling ; so that it has no acid salts ; but it deposited a small sediment of the same

same colour and substance with the calcarious incrustations of the well. I therefore in the next place pulveriz'd some of the incrustations brought from the well: Upon burning them over the fire they did not melt; had no particular taste or smell: Upon throwing some of the powder into the fire, concluding that if there were any sulphur in it the flame would have turn'd blue, it had no visible effect: I put a red-hot iron to it, but it sent forth neither smoke nor scent. Upon the whole, this water appeared simple and unimpregnated; nothing but the earth which forms the calcarious coverings of the roof and floor of the cave appearing in it. But when I say there is no steel, no alum, no acid salts or sulphur, I would not be thought peremptorily to assert, that there is nothing of that kind; I mean only, that there is not any one of these visibly predominant; for Nature mixes and qualifies her ingredients inimitably and inscrutably. We may positively affirm, that such and such ingredients are to be found unquestionably in Waters; but others may be also there in a quantity to us indiscoverable; and therefore we cannot absolutely affirm, that in any Water there is no such salt, steel, sulphur, or the like.

In Cornwall there is a great number of those Waters, which, from their principal ingredient, are called Chalybeate. The strongest Water of this kind, and most remarkable for its cures, which I have heard of, or had the opportunity of examining, is that which rises in the tenement of Colurian in the Parish of Ludgvan. The bed through which this Water flows, is a loose pebbly ground, mixed with a gravelly clay, full of the ochrous iron mineral, from which the taste and smell of the Water proceeds. Upon trying it several times with galls, it turned a deep reddish purple; with green tea, a lighter purple; with oak leaves, a blue-black of a purple cast. Upon pouring two thimbles full of spirit of vitriol into half a pint, it made but a small effervescence. I let the Water with the galls only stand for some time, and it retained its purple and transparency; whereas, if it had turned black and turbid, as some Waters do^b, that would have been a disadvantageous symptom. Upon dropping gently a large thimble full of syrup of violets, about three fourths of an inch of the Mineral Water, towards the top of the glass, kept its usual colour; the middle part turned to a pale greenish yellow, which reached to within half an inch of the bottom; and the remainder was of a light purple: but upon stirring it, after it had stood half an hour, the whole became a deep green. Upon dropping a thimble full of oil of tartar, it fell immediately to the bottom of the

SECT. IX.
Of Mineral
Waters.

^b Shaw on Mineral and Islington Waters, page 227.

glafs, which held about half a pint, but precipitated no sediment, nor turned the Water milky, thick, or chalky ; if there was any alteration, the colour seemed more inclinable to a bright ochre, but scarce discernable ; an experiment much in favour of this Water^c. Upon suspending a piece of polished silver for about an hour in the inclosed Well, the silver turned not blackish ; by which it appears, that little or no sulphur exhales from this Water. In the morning, before the Water is stirred, there is a film or skin on the surface of a rainbow colour, shooting to and fro ; by which may it be presumed, that there is a sulphur or naphtha mixed with this Water, which rises and settles on the top when the Water is left quiet for any time^d? In a calm but not very warm morning, on the 7th of August, 1734, O. S. before six o'clock, I found the Water, both in the inclosed Well and without, where it ran exposed to the air, almost blood-warm, and the common Water, which runs about nine feet from the Chalybeate, as cold as snow. I stayed some time, and found the difference still continue, by which it is to be concluded, that the Chalybeate Spring derives a sensible heat from the bed of iron, vitriol, and pyrites, which it passes thro'. Having carried the Water a mile or two, it lost that warmth ; whence we may infer, that such acidulæ as this cannot be so kindly to the stomach and intestines at a distance, as when drank on the spot. Being exposed to the open air for twenty-four hours, it suffers no alteration from galls ; and the steel being deserted by the volatile spirit, and the common menstruum imbibing the moisture of the adjacent air, becomes weaker, and a stringy yellow sediment may be observed making its way to the bottom of the glass. It is a smooth Water, mixes well with milk, and lathers easily with soap.

There are many living evidences, within the compass of my knowlege, of the great virtues of this Water. Two persons (of which I have sufficient proof), by drinking and washing the part affected, have been cured of the King's-evil ; and many others are said to have been so. It is very diuretick, passes forcibly by perspiration, promotes evacuation, removes obstructions and swellings of the abdomen, and restores lost appetite. Externally applied it cures sores and scrophulous eruptions, and is a very good collyrium for the eyes.

These virtues of Chalybeate Waters (usual in some degree, but seldom so eminently as here) make them a remedy of great extent for the disorders of the human body, and this is doubtless the reason

^c Shaw on Mineral and Islington Waters, page 159.

^d See Plot's Staffordshire, page 137, and Oxfordshire, page 44, Sect. lvi.

^e Mallow Chalyb. Water, in the county of

Cork, Ireland, raised Farenheit's Thermometer to sixty-nine degrees, when the adjoining brook sunk it to fifty. Bristol Hot Well, though not Chalybeate, raises the Thermometer to seventy-six.

Hist. of Cork, vol. II. p. 277.
that

that they are most kindly distributed into every corner almost of the world. But it must not be imagined that they can do no hurt: like all other medicines, they have their ill tendencies, when improperly applied, or used to excess; and therefore the time of using them, the necessary correctives in particular cases, as well as the quantity and time of omitting them, are surely best learned from a physician.

There are many other Wells of this kind in Cornwall^f; Iron, being more easily dissolved and imbibed by running Water than any other mineral, which is the reason that there are more Chalybeate, than Salt, Sulphurous, or Aluminous Springs; but the description of more than one, as the effects of all are so very like, would be needless, unless there was some remarkable cure, and peculiar property ascribed, neither of which has in any of them as yet reached my notice.

Many Naturalists have endeavoured to give us the analysis of those Waters: In all, the ingredients discovered are much the same (salts only excepted); and it is the different quantity of particular ingredients, and the proportion they bear to the Water, which is their vehicle, that makes them stronger or weaker. Our Spas in England are not so spirituous and pungent as the celebrated ones of Germany; yet, in many cases, they may be of great and extensive use; and, if I am well informed, the Spas of our own country may in most cases supply the place of the other, though more famous foreign waters.

As to saline, aluminous, hot, bitter, or sulphurous Waters, which deserve strictly to be so called, I have not been able to learn that there are any such in this County.

I have seen a letter from the late Mr. Vallack (an apothecary of character in the town of Plymouth, and among those of his business noted for his skill in chemistry), in which he affirms, that Carn-Kei Water, near Redruth, is impregnated with tin. His words are these, in a letter, dated January 5, 1741-2: "I have not only read in Mr. Boyle's History of Mineral Waters, but have seen the Water at Keyrn-Key, near Redruth, which I found impregnated both with iron and tin. It is the only Water I ever read of, or met with so mixed." This is very rare, but not improbable. I have had no opportunity of trying this Water myself, and therefore can neither confirm nor disprove what is said; but as tin is frequently found intimately connected with iron ore, I apprehend that the

^f Scarlet Well, near Bodman, was once much frequented, and is said to be much heavier than other Water, and will keep without alteration of scent or taste most part of a year; representing

many colours like that of a Rainbow. (Carew, page 127.) At present it is scarce known where this Well is to be found.

deposit of this Water might give sufficient reason for the assertion.

Petrifying Waters ; such, I mean, as will incrust bodies put into them with stone, I have not yet heard of any in Cornwall, except the Water at Holy Well, in Cuthbert, before-mentioned (pag. 32.) may be called so. Our River, Lake, or Sea Water, have not any taste, colour, or property, more than common, but must however be here treated of as to their rise, courses, extent, and issue, harbours, and tides ; their present usefulness, and their capacity of being render'd still more useful.

C H A P. IV.

Of the Rivers and navigable Creeks in Cornwall.

IN the middle of this County, betwixt the North and South Sea, the land is mountainous, (as has been observed before, chap. i.) and the mountains make a kind of broken chain the whole length of Cornwall ; the links of this chain are much more large and massive, if I may so say, in the East where the land is widest, but they contract and narrow themselves as they tend to the Westward, conforming their size, as well as shaping their course according to the land. On each side this high ridge the land spreads into a plainer surface, rather more hilly on the North than on the South, but on both sides declining to the sea. This general disposition of the land is far from being disadvantageous ; for the ridge of hills running nearly East and West, by intercepting the rain, fogs, and dews, distributes them again in plentiful and frequent streams, on either side watering the Sea Coast, the Northern Coast well, but the Southern much better ; an effect entirely owing to the rains being more frequent on the Southern side of our hills, than those which come from the North. Upon the whole, it may safely be asserted, that few spots of land of equal extent in England are so well watered as Cornwall.

Tamar.
Tamar^s is the Easternmost River in Cornwall ; it rises in Morwinstow, the most Northern parish of this County, about three miles from the Sea Coast : in June 1757 so inconsiderable at its source, that it was with some difficulty we found where it rises,

^s “A great number of our larger Rivers begin with the word Tav and Tiv, or, as antiently written, Tam or Tim. Hence Thame or Thames, Tav, Taüy, &c. This Tam is in all probability the same with the Greek Tamos in Ταμος, τω in Greek being an old prepositive.” Lhuyd in Bax-

ter’s Glossar. page 265. “Mâr, Mêr, and Môr, signified antiently Water as well as Sea,” ibid. page 266. Tamar therefore signifies the large River-water, and should be written Tamar, quasi Tau-mar.

which

which was on the summit of a moor, from whence the ground, declining to the North, makes way for part of the water to run northerly, which is the head of the River Tarride, navigable a little above the town of Bideford, and the ground shelving away on the other side at the same time to the South, drains away the bogs of the same moor to the Southward from the same fountain, and forms the beginning of Tamar, which, at the distance of ten miles, becomes considerable enough to give name to the small parish and village of North Tamerton^h, where leaving a bridge of stone, it continues on to the South till it enters the parish of St. Stephen'sⁱ, at the corner of which parish it receives a very plentiful stream, called Werington River. About a mile and half farther down it receives the Aterey^k River (which runs under the walls of Lanceston), and becomes soon after, at Polstun bridge^l, a considerable, wide, and rapid stream. Hence it coasts on nearly South, receiving the brooks from each side, till it has passed Graistun^m bridgeⁿ, a mile below which, it receives the Lowley River, and soon after a more plentiful stream from Altarnun, Lewanic, and Lezant parishes, called the Inny, and the place where it joins the Tamar, called Inny-foot^o. The Tamar increasing still, has a high, strong, stone bridge, in Stokelynsland, called commonly Horse Bridge, but by Leland^p Hawtebrig; that is, High Bridge. The last bridge on this River is in the parish of Calstok, begun, says Leland^q, by Sir Perse Edgcumbe^r. The tide almost reached this bridge in the time of Henry VIII^s; but it was navigable no further than Morleham, about two miles below, to which small barks still come. Five miles farther down, the Tamar receives the Tavy on the East, and, having made a Creek into the parishes of Botsfleming and Landulph on the West, becomes a spacious harbour, and washing the foot of the antient borough of Saltash within half a mile, is joined by the Lynher Creek and River, then passing straight forward forms the noble harbour of Hamoze^t, called formerly Tamerworth^u; where making two large Creeks, one called St. John's, the other Millbrook, at the West, and Stonehouse Creek at the East, (after a course of about forty miles, nearly South) the Tamar passes into the Sea, having Mount Edgcumbe for its western, and the lands of Stonehouse and St. Ni-

^h The Tamara of Ptolemy, as is supposed, Camden's last edition, page 25.

ⁱ By Lanceston.

^k "A Broke renning in the botom in the Suburb, caullid Aterey." Leland, Itin. vol. III. page 115.

^l A large and fair building of stone, built, as Leland says, ib. by the Abby of Tavystock.

^m So in Leland, ib. for Greystone.

ⁿ A light, handsome work of stone, consisting of nine arches; the tread of it 3:8 feet long, twelve feet wide between the walls, and twenty-seven high

from the water, in summer.

^o The same River gives name also to a wood in the Manor of Lawhitton, called Inny-ham Wood.

^p Vol. II. page 78.

^q Ibid.

^r It is sometimes called Newbridge, sometimes Caulstoke Bridge. See Leland, vol. III. page 29.

^s Leland, ib.

^t Saxon name Ham-oze; that is, the wet oozy habitation, circuit, or inclosure.

^u Camden, page 26.

cholas Island, in Plymouth Sound, for the eastern boundary. This River, by the appointment of King Athelstan, the Saxon, (A. D. 938.) was to be the general boundary of the Cornish Britans; but when the Normans came in, and the Kingdom became subdivided into Lordships and Manors, (those little Kingdoms within a Kingdom) Barons, jealous of the extent, rights, and honours of their Manors, procured their lands on the borders, to be appropriated to the county in which their domains and chief places of residence were fixed*. Hence it happens that this Saxon law of Athelstan in four instances has given way to the succeeding regulations of the Normans, and though the River is reckoned in Cornwall^x, yet Devonshire intrudes for seven miles in length and three in breadth at Werington, and claims the two parishes there of Werington and North Pedherwyn, as it does also the mansion, domain, and park of Mount Edgcumbe, at the Tamar's mouth. This last incroachment upon the general boundary was owing probably to the powerful interest of the Valtorts (a noble family of large revenues in Cornwall, but usually resident in Devon) antiently proprietors of the place now called Mount Edgcumbe; and, as I imagine, the former was owing to the like interest and application of the Abby of Tavystock in Devon, which had the property of Werington, and (as Leland says, vol. III. page 115.) "had fair landes thereabout." But though these places were, by the interposition of their Lords, subjected to the civil authority of Devon, yet care was taken to preserve the rights of the Clergy inviolate: they are taxed as belonging to the Hundreds of Cornwall in the Lincoln taxation, made in the 16th of Edward I. A. D. 1288, and they still continue subject to the jurisdiction of the Archdeacon of Cornwall. On the other hand, Cornwall also exceeds its antient limits near North Tamerton, having a small slip of land of about two miles square on the eastern bank, but why, I am not informed: again, over against Saltash, it claims a small portion of land not a mile square, owing, as I imagine, to the application of the Lords of Saltash, and the Castle of Trematon adjoining.

River Lyn-
her.

The next considerable River is the Lynher, called so from the Lake it makes before it joins the Tamar at Hamoze^y. It rises on the hills of Altarnun parish, about eight miles West of Lanceston, coasts down to the South South East through the parishes of North-hill, Linkinhorn, and South-hill; and passing about a mile from the

* There are some instances of this kind in other counties, and indeed in foreign countries, particularly in Germany, where all the possessions of the House of Austria are accounted in that circle, let them lie within what other circle soever. Plot, Oxfordshire, chap vi. sect. lxxxv.

^x "The jurisdiction of the Water doth wholly appertain to the Dutchy of Cornwall, and may

therefore be claimed as a part of that County." Carew, page 99. which is confirmed also by the profits of the passage at Saltaſche, the tax on all boats and barges that pertain to the harbour yearly, and the anchorage and foilage of all straunger ships; all belonging to the borough of Saltaſche in Cornwall." Norden, page 98.

^y See Leland Itin. vol. V. p. 79.

borough

borough of Calinton, divides the park at Newton-ferrers, formerly the Seat of the late Sir John Coryton, Bart. and by Pillaton and Lanrake comes to Natter (alias Noddetor) Bridge^z, where it is navigable, and, by the help of the Sea, begins Lynher Creek: hence continuing its course four miles farther, between the parishes of Cheviock and St. Stephens, it then turns to the East, and, agreeably to its name Lynher^a, making a fair haven betwixt East Anthony and St. Stephen's, joins the Tamar, after a course of about twenty-four miles. In the summer this stream is small, but in the winter rapid, overflowing, and dangerous, of which alternate extremes Mr. Carew (page 111.) in quaint, but not unharmonious strain, thus expresses himself according to the manner of his time*.

I.

When sun the earth least shadow spares,
And highest stalls in heaven his seat,
Then Lyner's peebly bones he bares,
Who like a lamb doth lowly bleat,
And faintly sliding, every rock
Plucks from his foamy fleece a lock.

II.

Before a River, now a Rill,
Before a fence, now scarce a bound,
Children him o'erleap at will,
Small beasts his deepest bottom sound,
The heavens with brafs enarch his head,
And earth of iron makes his bed.

III.

But when the milder-mooded skie
His face in mourning weeds doth wrap,
For absence of his clearest die,
And drops tears in his center's lap,
Lyner 'gynnes lion-like to roare,
And scorns old bankes should bound him more.

IV.

Then, second Sea, he rolles, and bears
Rocks in his wombe, rickes on his backe,
Downe-borne bridges, up-torne wears,
Witnesse and wayle his force, their wracke

^z Leland, vol. III. page 28, calls it Natter; and so again, ib. page 29. Carew, page 54, calls it Noddetor Bridge.

^a Lyn in the Cornubritish signifying a Lake, it being not unusual to denominate Rivers from the

extraordinary spread of water they make in some particular place: thus we have in this County three Rivers called Lo, from their making a lake at their mouth: hēr signif: long; Lynher, longus lacus.

* Reign of Elizabeth.

Into men's houses fierce he breakes,
And on each stop his rage he wreakes.

V.

Shepheard adiews his swymming flocke,
The hinde his whelmed harvest hope,
The strongest rampire fears his shooke,
Plaines scarce can serve to give him scope,
Nor hills a barre, wherefo he stray'th
Ensue losſ, terrour, ruine, death.

River Tide,
or Tidi.

The Lynher Creek, about four miles below Natter bridge, joins St. German's Creek, made by the River Tidi, which has its rise on the South side of Caradon Hill, near Liskerd, where there is a place called Tidicomb, another Tidewell; and after dividing Quethiok parish from Minheneth; it enters the parish of St. German near Molinic, and about two miles lower becomes navigable at a place called Tidiford, (or the first ford on the Tidi) about two miles lower, it washes the sides of the antient borough and formerly Episcopal See of St. German, whence the Creek below is called St. German's Creek; and joining the Lynher, they both together proceed into the Tamar.

Seaton River. Seaton is the next River: it rises in St. Clare, about four miles to the North-East of Liskerd; and passing within a mile of that borough to a place thence called Lanseaton, goes through Minheneth parish, and dividing St. German's on the East from Morval, and St. Martin's on the Western bank, falls into the Sea at Seaton, after a course of about twelve miles. The antient town, which probably gave name to this water, must have lain at its mouth, or opening into the Sea; but there are no remains to be seen: the town therefore has probably been swallowed up by the encroachments of the Sea, which in this place have been very considerable, if we may regard the tradition of the neighbourhood.

Loo, or East Loo River. Loo, or East Loo^b, has its rise also in the highlands of St. Clare; and passing under Liskerd park, divides Keyne parish from Liskerd, then Morval from Dulo; and becoming navigable at Sand-place, empties itself, about three miles after, between two little boroughs, which have their nancies, East Loo and West Loo, from the River, as the River has its name from the large Pool, which it makes every full tide, between the two towns. Its whole course is about ten miles. Here is a stone bridge of fifteen arches^c, one hundred and forty-one yards long, and six feet three inches wide betwixt the

^b Also Loow and Loowe, Leland, vol. VII. page 113. and Low, ib. page 114. and vol. III. page 26. Wallice Lhuch, Cornu-brit. Luh. Ir.

Lough. Scot. Loch. Anglicè, Lake, Pond, or Pool.
^c Including two square openings made for the more commodiously passing boats laden with wood.

walls.

Scale of 100 Yards. 10 20 30 40 50 60 70 80 90 100

pag. 40.



To James Buller Esq: Member of Parliament
for the County of Cornwall this View of the Port and
part of the Boroughs of East and West. Soo engrav'd



for the County of Cornwall this View of the Port and
at his expence is most gratefully inscribed by Wm Borlase.

walls. Here is a stone bridge of 15 arches^c: below this bridge is the Creek, which, thro' a narrow gut, admits the tide, and with its small barks.

One mile below Sand-place, the Loo is joined by another stream from the West, called Dulo; that is, the Black Loo, or Water^d. The district through which it mostly runs, is called Dulo, or Duloo parish, as 'tis reasonable to conjecture, from some apparent darkness in colour sufficient to distinguish it from the adjoining stream of East Loo, whose whole course is at a medium not two miles distant. This water rises in the parish of St. Pinok, and coasting nearly South, becomes navigable at Trelaun wear, about two miles from the Sea; a mile after it joins the East Loo, and they both pass the stone bridge above-mentioned into Loo Creek; its whole course being about seven miles.

Fawy^e rises in Fawy moor^f, at a place called Fawy Well, in the Fawy River. parish of Altarnun, not far from Brownwilly, one of the highest mountains in Cornwall^g. The higher part of this River is also called Draines, and the first bridge upon it is by Leland^h called Draines Bridge; after which passing three other bridgesⁱ, and having taken into its stream the Rivulets of St. Neot's, Warlegan, and Cardinham parishes, it comes to Resprin, alias Laprin^k Bridge, whence, in about three miles, it reaches the borough of Lostwythiel, where it passes a fair stone bridge of nine arches, of which the water at present only useth three. In former ages the sea ebbed and flowed above this town^j, and Camden says brought up vessels of good burthen: at present loaden barges scarce come within a mile of it. In three miles more the Fawy, having taken Pellyn Brook from the West, receives the water of Leryn River and Creek from the East, and becomes thence a deep and wide Haven: in two miles more it reaches the town and borough of Fawy on the western bank; and a little below, being joined by Polruan creek and brook from the East, opens into the Sea, after a run of twenty-six miles, betwixt two old towers (built in the reign of Edward IV^m.) from which there formerly stretched a chain for the defence of the harbour. This is thought the largest body of fresh water, except the Tamar, in all this county.

^c Including two square openings made for the more commodiously passing boats laden with wood.

^d Waters oftentimes take their names from some remarkable colour, either of the water itself, or the sand or banks which they pass by; of which we may see several instances from Lhuyd, in Baxter's Glossary, page 266.

^e In Lincoln Taxat. Faue; in Leland, vol. III. page 22, &c. Fawey, redditus Fawy or Fauy, a favea, & wy aqua; that is, the water of the deep ditch, vault, or den.

^f "In a very wagmore in the side of a hill."

Leland, vol. III. page 24.

^g On the banks of this River are three tenements, called Fauton in maps, but in the records Fawton, or the Town on the Fawy. See records of Knights Fees, taken from the third of Henry IV. Carew, page 42.

^h Vol. II. page 24.

ⁱ Clobha, Lergen, and Newbridge. Leland, ibid.

^k Leland, ibid.

^l Leland, vol. III. page 23.

^m Ibid. page 22.

Dulo, or
West Loo
River.

River Fal.

The next navigable stream is the Falⁿ, which rises at a place called Fenton Val, (that is, the source of Fal) about two miles West of Roche Hills, and running about eight miles to the South, may be called a plentiful stream at the borough of Granpont, where it passes under a stone bridge that gave the present name to this borough, but has nothing else remarkable. About a mile below this bridge the River was formerly navigable, at least for boats; but is now deprived of that great advantage; in three miles farther, it reaches the borough and bridge of Tregeny. To this place in the last century the design of making the River Fal navigable by sluices up to Granpont was nearly completed by one Colonel Trevanion; but this attempt, so much for the benefit of the adjacent country, had no consequence but what should be mentioned with concern; I mean, that of exhausting the private purse of this public-spirited Gentleman. A mile below Tregeny Bridge the waters begin to spread, and assisted by the tide, and many little brooks on either hand, forms a Creek, about three miles long, called Lâmoran^o Creek. Here, having washed the Southern side of the lands and park of Tregothnan, seat of the Right Honourable Lord Viscount Falmouth, it is joined by Truro Creek, a noble body of water to which the Rivers of Kenwyn and St. Allen give the first rise, and meeting at the borough of Truro, make with the tide a navigable chanel for ships of 100 ton burthen to come up to the town Kaye. From Truro, after making a small Creek to the West, in two miles it joins St. Clement's Creek, which is navigable for barges, three miles to the East, as far as Tresilien Bridge. Truro Creek and St. Clement's at their meeting make Môrpa^ps Rode, and proceeding about a mile farther, meet the Fal at the mouth of Lâmoran Creek, whence they all together, under the name of Fal, in two miles more reach the principal branch of Falmouth Harbour, called Carreg Rode; hither flows from the Westward Tretheag River, and with some other Brooks from the North form Restronget Creek^q. Melor, or Milor Creek is next; small, but sheltered^r: then comes the great Creek, or rather Harbour, called King's-Rode, which has Flushing to the East, and the populous town of Falmouth to the West, and is navigable two miles up to the borough and port of Penryn, whither ships of 100 ton and somewhat more may come up. A little below this last-mentioned town, on each side of the Creek, there was a jutting head, and, to guard the gap between,

ⁿ In Leland, Vol. iii. page 17, Fala, unde Coit Fala; that is, Fala-wood; the antient name of Granpont, more antiently still called Vol and Cenio.

^o The Church of St. Moran, says Leland, vol. III. page 17, or, as is more probable, from Morraun, or Morhaun; that is, the River Haven,

scil: where the River and Sea meet.

^p That is, the passage over the Sea; in Leland, called Maples Rode.

^q Leland, vol. III. page 16.

^r Wherein the greatest flipp that failes may ryde saufe. Norden's Survey of Cornwall, p. 47.

there

there was a chain in the time of Leland^s; but such unwieldy defences are become in a manner needless, since the improvements of naval architecture have so much advanced the Royal Navy. The Creeks on the Eastern bank of this harbour are the little Creek of St. Just, and the irregularly wandering one of St. Maudit's; and all these branches being united in Carreg Rode, as the stem and trunk, (four miles long, above a mile wide, and fourteen fathom deep) the Fal runs into the Sea betwixt Pendinas Castle on the Western bank, and St. Maudit's and Anthony Point on the East: the opening here into the Ocean is near a mile wide, deep chanel, but near the middle a large rock^t, most dangerous when the water is most deep; for then it is hid. To remedy in some measure this danger, the heirs of Killigrew, Lords of Pendinas Castle, (which guards this entrance) are obliged to keep a tall pole fixed on the highest part of the rock. Notwithstanding this inconveniency, the harbour of Falmouth must be reckoned among the most secure and capacious harbours belonging to the crown of Great Britain. Leland^u calls it "a very notable and famous, and in a manner the principal haven of all Britain." Camden equals it to Brundusium, in Italy; and Carew, Camden, and Speed, agree, that a hundred sail of ships may anchor in it, and no one see the other's top^v. Hamoze Harbour, at the mouth of Tamar, is reckoned to be better set off with prospects of seats, towns, and gently declining shores, and has a greater space of deep water for the Royal Navy; but Falmouth has a bolder shore, is better secured with hills and winding creeks for trading vessels, and its situation more convenient for getting clear of the chanel: in short, yielding only to Milford Haven on the coast of Wales, it is generally reckoned the second harbour of Great Britain.

This River is called Hél, and the first ford over it Hélford^x. Hél or Heyl River, in Kerrier. The head of it lies upon the hills of Wendron parish, near Penhâl Guy (i. e. water coming from the head of the hill) whence it runs, in about three miles, to a village called Guyk^y, whither, by help of the tide, barks come up. A mile farther down the Hél is joined by Maugan Creek on the South, and three miles farther by Kestel or Hélford Creek, where there is a passing boat, and at its mouth, three miles farther, by Gillan Creek. On the North it has first

^s Vol. III. page 15.

^t Called by Leland, vol. VII. page 111. Caregroyne; that is, "Insula, vel rupes Vitulorum marinorum;" Anglice, Seals; or perhaps from Careg, rock, and grûn or Wallicé grwnn, a ridge of land between two furrows (Richard's Dictionary); for such indeed this is: but it must be owned, that it is usual with sailors to call rocks after the names of animals; as the Wolf Rock, the Cow and Calf, the Shark, &c. from some imaginary resemblance.

^u Vol. V. page 111.

^v Carew, 150. Camden, 16. Speed, lib. i.

chap. xi. page 21.

^x Hail and Heil by Leland, vol. III. page 12. and Heyle, Heyl, and Hayl, ibid. vol. VII. page 110. This seems to be a common name for a River. On the North Sea we have one in the Hundred of Penwith; on the Alan we have a Church called Egloshâl; that is, the Church on the river Hél; and the Alan, near its source, is called Cam-hél, unde Camelford.

^y That is, Guyk, the Watery Village, or Village on the Guy.

Polpenrith, alias Polpere, and Polwevorēl Creeks, running up towards Constantine Church ; and a mile farther down, Chielow, alias Calmansake Creek (Leland III. 13).² This haven, within a mile of it's mouth, is secure enough for ships of 200 ton ; and at it's passage into the sea, is about a mile wide.

Lo, or Low River, in Kerrier. This River rises in the highest Northern part of Wendron parish, whence, in about five miles, it reaches the borough of Helston ; about a mile below which it forms a Lake, called the Lo Pool ; the River giving rise to the Lake, and the Lake, as the most remarkable part of the Water, giving name to the River³.

Heyl River, in Penwith. Four brooks give rise to this River⁴ ; and uniting at Relubbas from a Western Course, turn to the North, and in three miles reach St. Erth, alias St. Ercy Bridge, of three stone Arches, and a raised Causey well walled on each side, reaching cross the valley. The Bridge has been built somewhat more than 400 years⁵, before which time there was a ferry here, and ships of great burden came up to it. The valley, above bridge, has been much raised by the sands and earth, washed down from the hills and mines ; and the haven below has suffered the same misfortune, from the sands of the Northern sea ; so that lighters only come within a bow-shot of the bridge ; and that with the tide of flood, which at spring tides flows near a mile above the bridge. Here the land of Cornwall, is at it's narrowest dimension ; so that from the full sea mark of Heyl on the North Sea, to the full Sea-mark at Marazion in Mount's Bay on the South Sea, the distance is but three miles. From St. Erth the Heyl bears directly North, spreading an area of sand, of half a mile wide at a medium, and two miles long, but navigable only in the chanel of the River, which admits small ships a mile inwards from the sea under the village of Lannant. Near it's mouth the Heyl is joined by a brook from the East, which, under the Parochial Church of Philac, makes a branch of this haven for ships of 100 tons. The Sea has not only almost filled this small harbour with sand, but forms a bar also at it's mouth, over which ships of 80 and 100 ton only can come in at the height of a spring tide ; and the bed of the whole is so raised, that it admits the tide in it only six hours in twelve ; so that whereas, in harbours open to the sea, the tide flows six hours, and ebbs six hours : here 'tis

² Kilmanach, the Monks Cell ; Chielow, or Killow ; that is, the cell or house on the water or lake.

³ By Leland called Hailston, vol. iii. page 12. by mistake for Héllas, or Hél-las-ton ; that is, the town on the Green River ; waters often taking this part of their name from their colour ; as Cam-las, the Green Cam ; in Merionethshire, Caernarvonshire, and Brecknockshire, Dulas ; in Brecknockshire, Morlās aqua cœrulea ; Lhuyd

in Baxter, 274. Yr avon las the Green River in Glamorganshire, ibid page 266.

⁴ In Speed, and Camden's maps, and Norden, page 22, this river is called Cober, a mistake (as I apprehend) for Lober ; (that is, the bar of the Lo) a sandy pebbly bank, thrown up by the sea at the mouth of this river, and serving as a dam to form the Lake.

⁵ Leland, Vol. iii. page 10.

⁶ Leland, ibid.

otherwise ;

otherwise ; the tide has flowed three hours before it can enter Heyl, and it ebbs three hours in the open Sea after the tide has quite disappeared in Heyl : 'tis therefore but a half-tide haven : yet, notwithstanding this, 'tis a place of considerable trade for iron, Bristol wares, but more especially Welsh coal, for which at present there is such a demand for fire-engines, melting-houses, and the home-consumption of a populous neighbourhood, that usually there are above five hundred, oftentimes a thousand horses, which come to carry off coals, for some purpose or other, six days in the week. The fire-engines, which take off the greatest quantity of coal from this harbour, are still increasing in number, and the trade here must proportionably advance.

Ganal Creek ^e runs up into the land from the North or Severn Sea, as it is sometimes called, about two miles, where it meets the River, which rises in the parish of Newlan, near Trerice, the paternal seat of Lord Arundel of Trerice. This water was more considerable formerly, but, like our other little havens on the North Sea, has suffered much from the plenty of Sea-sand, with which the North Channel so much abounds, that every storm from the West and North throws it in more or less upon the creeks and havens, and in many places upon the hills. At the mouth of the Ganal stands a little village, called Carantoc, from the Saint to whom the parish Church is dedicated. Tradition says, that it was antiently a large town, and very probably it was so, the religious house here being the residence of a Dean and nine Prebends. Sloops of thirty tons only can frequent this Creek.

We proceed next to the greatest River on the North of Cornwall, ^{River Alan.} at present commonly called the Camél (that is, the crooked River), from the many turnings in its course, especially from the sharp angle it makes near Bodman, where, from a South South West course of twelve miles or more, it bears for the Sea North North West. It was also called in Leland's time ^f Dunmère ; that is, the Water of the Hills ; and the bridge over it, near Bodman, is still called Dunmere Bridge. It was also "called Cablan in some histories ^g ;" but this is only a contraction of Cabm Alan, that is, the crooked Alan ; (not Camblan, as in Camden ^h,) the b being inserted before the m by the Cornish idiom ⁱ ; for Alan is indeed the proper name *. This River rises about two miles North of the borough of Camelford, where its banks are famous for two considerable battles ; the first

^e Kanal, or Ganal, is a word borrowed by the Cornish from the Latin *Canalis*, signifying a channel, Creek, or narrow arm of the Sea. Thus there is Kanal Idzhy, in the parish of St. Ifsy, signifying St. Ifsy's Creek ; and here is Kanal in a like situation. Mr. Lhuyd says, that the Cornish use the word Shanol for *Canalis* (Compar. Etymol.

in voce). Here it is Kanal or Ganal, the k being often changed into g.

^f Vol. VII. page 106.

^g Says Leland, ib.

^h Last Edition, page 23.

ⁱ As crobm for crom, &c.

* Leland, ibid.

in which King Arthur received his mortal wound: thus recorded by the Poet ^k:

- - - - - “*Naturam Cambela fontis
Mutatam stupet esse sui, transcendit in undas
Sanguineus torrens ripas, et dicit in æquor
Corpora cæsorum; plures natare videres,
Et petere auxilium quos undis vita reliquit.*”

The other, a bloody battle, fought betwixt the Cornish, and the West Saxons of Devonshire, in the year 824^l, in which many thousands fell on each side, and the victory remained uncertain. Hence, after a run of about 12 miles, it becomes navigable for sand barges at Parbrook; and at Egloshâl^m, receives a plentiful addition to its stream, from the River Laineⁿ. A mile farther down, this River reaches the greatest bridge in this county, called Wadebridge: about the year 1460^o; there was a ferry here whilst the tide was in, and a very dangerous ford when the tide was retired, which moved the then Vicar of Egloshâl, one Mr. Lovebon, with great industry and public spirit, to undertake this bridge; a great and useful, but tedious work. Besides the expence, so disproportioned to his circumstances, in the course of the work, there arose such difficulties, as might have baffled a more mechanical age than that in which he lived: the ground, for the foundation of some of the piers, proved so swampy, that after repeated efforts another way, they were forced at last to build on wool-packs; however, it should never be forgotten, that by his solicitations, and the liberal contributions of others, but chiefly by his own perseverance, and the blessings of providence, he lived to accomplish the bridge as it now stands, with seventeen fair and uniform arches, reaching quite cross the valley, to the great safety of travellers, and the credit of his country. Hither come up small barks of 40 and 60 ton, and supply the country with coal from Wales, with flat, which rises about ten miles off, lime, timber, and groceries from Bristol. A mile farther down the Alan makes two small Creeks on the East, in return for a brook or two which it receives; then keeping to the North-West, and supplying two Creeks on the Western bank which run up into St. Ifsy, and little Petrock parishes, in a mile more it reaches the antient town of Petrockstow, alias Padstow, where there is a pier, and some

^k In Camden, page 23.

^l See Saxon chronicle.

^m That is, the Church on the River.

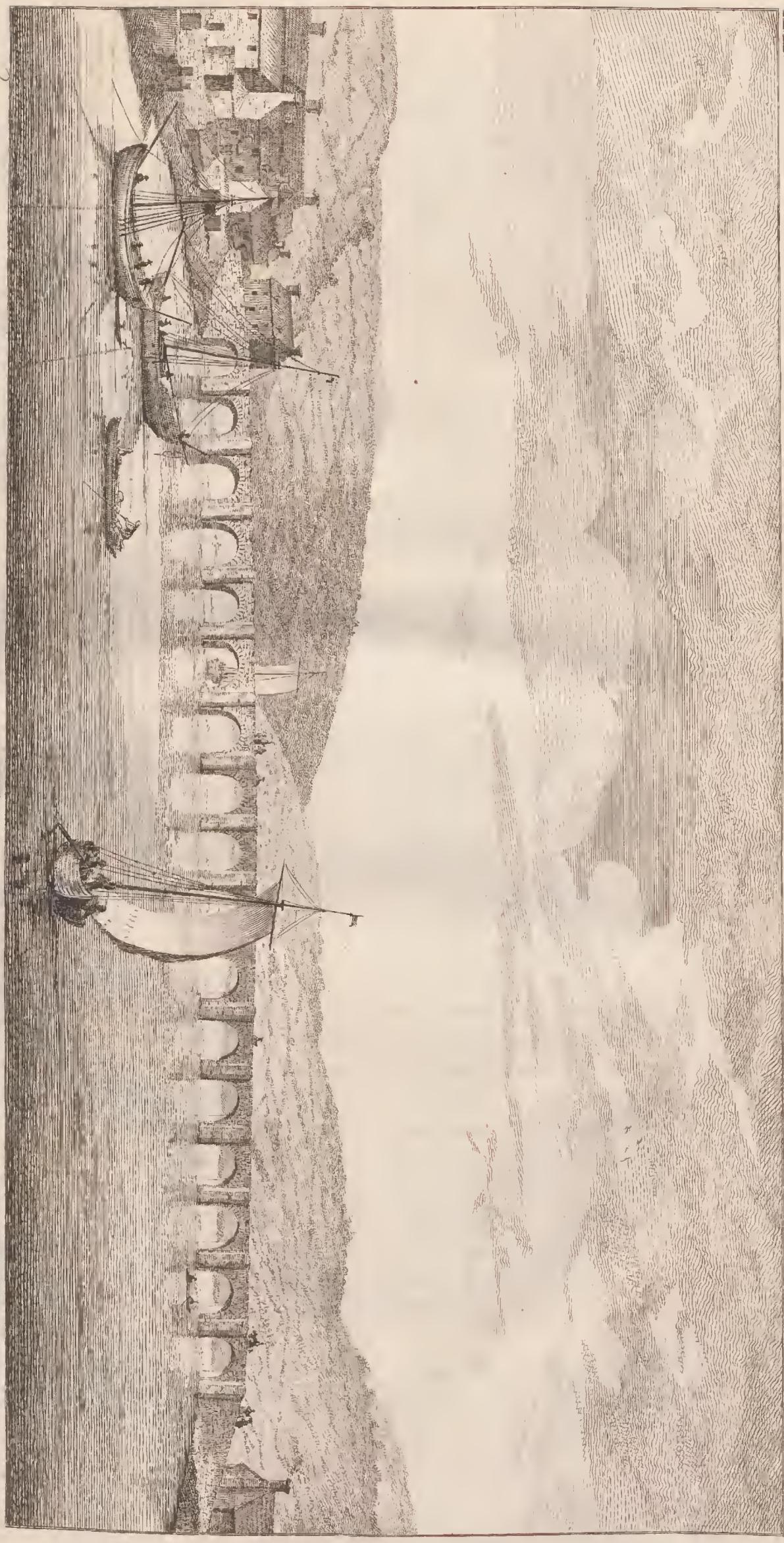
ⁿ Some Rivers among the British, says Lhuyd in Baxter's glossary, page 273, take their names from animals; as the Caru (*Cervus*) in Shropshire,

and the Elaine, (*Hinnulus*) in Radnorshire, and Montgomeryshire, &c. probably this River Lain, had the name of Elaine from the swiftness of its course.

^o Leland, Vol. II. page 82.

Scale of two Yards.
10 20 30 40 50 60 70 80 90 100

pa. 40



To John Moleworth Esq. this North View of
WADEBRIDGE, in Cornwall, engraved at his expence,
is most gratefully
inscribed by
Wm Borlase.



trade from Ireland, Wales, and the Bristol channel. Here at Padstow the Alan is near a mile wide, and there is a ferry-boat to cross. At the mouth of this harbour, about two miles below the town, the Sea, as in all our harbours on the North channel, has acted against itself, and thrown a bar of sand across the haven, which prevents ships of more than 200 tons from coming in at all, and makes it hazardous even for the smaller ships to come in, but when the tides are high and the weather fair.

Farther up on the Northern side of Cornwall, there is no considerable or navigable River; but we find the Creeks of Portfisc, and Botreaux Castle, and Bude Haven, which name, the last Creek, had it not been formerly a more considerable retreat for shipping than it is now, could never have deserved; but indeed, what seems anti-ently to have been the haven, is now all marsh and meadow ground, reaching from the Barton of Whalsborough nearly to the town of Stratton, about two miles long, and little less wide. In the middle of this marsh runs the River, which, with the tide, makes the present Creek, and opens into the Sea by a narrow passage.

Before I take my leave of the navigable Rivers of Cornwall, I cannot help observing, that there is scarce any one of them so destitute of water, or so distressed by untoward levels, but that their navigation may be either extended or improved: but some improvements are more desirable as they will be more advantageous to the country, and more easily effected than others: their neglect is therefore the more affecting. Lanceston is a populous town, and in the neighbourhood many families of rank and fortune, and in general the country round is well peopled and cultivated; yet all the coal for firing, fir-timber for building, all foreign products, all goods from London, Exeter, and Plymouth, all sea-sand for manure, they are forced to send for ten miles at least, and have them all from Morlham or Boscastle, which is still further, by land-carriage, through ways in general egregiously bad; difficulties which necessarily occasion little trade, and scanty employment for the poor. Now the Tamar passes within a mile and half of this town (a little above Polstun Bridge) where it is a noble stream of water, a wide chanel, and receives the Aterey River coming directly from the walls of Lanceston: hence the Tamar sets to the South, so directly, that it is but little more by water than by land. Surely so rich and populous a neighbourhood as this, might be well requited for the charge of making, or at least for exerting all their interest to make this River navigable at the public expence for the short space of ten or twelve miles.

Another improvement pointed out by nature is, the uniting the Fawy, on the South Coast, with the Alan on the North. These

two

two considerable rivers come so near each other in the middle of the County, that they almost cut it in twain. From Lostwythel (where the tide from the South now reaches) to Parbrök, whither the tide comes up from the North, the distance is eight miles; but from Resprin Bridge, near Lanhydroc Park, to Dunmere Bridge, about a mile from the town of Bodman, (at both which places the streams are considerable) the distance is but four miles; and in this intermediate space, many lesser streams occur, which might come in aid, to promote the union of the North and South Coasts. The advantages of such an union, are too obvious to be particularized, and the difficulties too few to discourage the undertaking, whenever a public spirit, for rendering rivers navigable, shall arise in this nation. It is indeed to be wished, that as the eyes of all begin to see the advantage of good roads for trade and travellers, so they may in time awake, and perceive the greater, at least equal advantage of improving the water-carriage of this nation. Most of our creeks are capable of being made navigable higher up into the country, than they are at present; and indeed were so formerly: and though this might seem needless here in Cornwall, where the sea is so near us on either hand, yet I think this is a strong argument for, instead of being against the improvement of our water-carriage; it being evidently of so much the less difficulty, as the space is short, and of so much the greater advantage than making Rivers navigable in an inland country, as the products of the Sea, and the Sea-coast commerce, must exceed the products of any one inland county. But farther: As nature has denied other manures, such as lime, chalk, marle, or rather art has not yet discovered them in any answerable goodness and plenty, Sea-sand and ore-weed may be reckoned our principal and most prolific manures; and so many of our farmers are forced to carry sand six, eight, or ten miles, and sometimes more, that in the Philosophical Transactions, April 1675, in a letter to Dr. Daniel Cox, I find the carriage is estimated at 32,000l. a year: if therefore we were to receive no other benefit than the saving in this one article of Sea-sand, which surely might be reckoned one half of the present carriage, it could not be unworthy the publick notice of this County. But many other and still greater conveniences are obvious, such as bringing up timber and other materials for building, and tin-works, carrying, recarrying, and exporting metals, communicating necessaries from London and Bristol, introducing the products of foreign countries, easier conveyance of coal, and wood (with which the sides of our navigable Rivers are remarkably well furnished) for firing. These apparent advantages of improving our navigable Rivers moved some worthy patriots of the last century to make an essay on one particular

ticular River¹, that they might the better estimate the expence, and apply more successfully for the assistance of Parliament. Accordingly they finished one lock, with its leat twelve feet wide, which raised the water eight feet, at the charge of sixty pounds. This was looked upon as so great an encouragement, that a bill was brought into Parliament to make all the Rivers in Cornwall, whieh were capable of such improvement, navigable: the bill passed the House of Commons with great approbation: it was afterwards introduced into the House of Lords with words to this effect; That it was a noble design, and might give a pattern for all England to follow*; but it went no farther, it being then but four days to the end of the session; and the civil wars of Charles I. soon after ensuing, put an end to this beneficial attempt, and deferred the glory of accomplishing it, till the like spirit is happy enough to associate with more power.

It is hinted before, that our Rivers and Creeks were formerly navigable much higher up than they are now: the truth is, the beds of the Rivers are raised several feet perpendicular by the earth, sand, and gravel from the hills: this is natural in all places, in proportion to the quantity of rain, the declivity of the grounds, and the largeness of Rivers; but with us in Cornwall much promoted by digging and streaming for, stamping and dressing our metals, all performed at the water side, and the refuse all washed into the Rivers, thence into our harbours. This is a growing evil, complained of by Leland, and Carew, (page 27) but still unredressed; and as there are many more mines now than formerly, the beds of our Rivers will rise proportionably quicker than in former times, and make it still more difficult to continue the navigation even upon its present footing. There was an act of Parliament, made in the 23d of Henry VIII. "that none should labour in tin-works near the Devon and Cornish havens" (Carew, page 27); and though this act is obsolete, it might possibly be re-enacted upon proper application, and be made more effectual to answer the salutary purposes intended.

C H A P. V.

Of the Lakes and Sea of Cornwall.

AS one general ridge of hills runs through the middle of SECT.I. this County, and the Sea is so near on either hand, the rivers, which rise in the higher grounds, have but a short passage to the ocean; and meeting with no considerable impediments, few only and small Lakes are formed.

¹ Supposed to be the Lynher.

* Letter to the author from J. Frehawk, Esq;

SECT. II. Four miles North of the church of St. Neot's, about fourteen miles from Loo, on the South Sea, and as many from the head lands of St. Gennys, on the North Sea, the waters of the hills adjoining gather into a bason, and make a small Lake of about a mile in compass, called Dôzmery Pool': Leland says, it was reckoned fourteen or fifteen fathom deep; but Mr. Carew, page 112 (better informed by experience) says, that upon tryal, no place in it was found deeper than nine feet, and no fish but Eels.

SECT. III. Betwixt the parish of Budoc, in the Hundred of Kerrier, and Swan Pool. that of Falmouth, a small Creek, not half a mile long, nor a quarter wide, is sever'd from the sea by a bar of sand and shingle. This is now called the Swan Pool; (from the Swans kept here some years since by the Killigrews, Lords of the soil) but in Leland's time[•], Levine Prisklo, alias Levine Pool. The Eels of this water are reckoned extremely good.

SECT. IV. The most considerable Lake we have in Cornwall is the Lo Pool, Lo Pool. betwixt the parish of Sithney on the West, and those of Helston, and Maugan on the East. The Lake is about two miles long, and a furlong wide, formed by a bar of pebbles, sand, and shingle, forced up against the mouth of this Creek by the South West winds'; the valley here betwixt high lands on each side giving vent to, and thereby increasing the force and velocity of the winds from this quarter. This bar dams up the water which comes down principally from the Lo River, till it comes to a stone bridge, (from an hospital of the Templars dedicated to St. John) called St. John's Bridge, but is fed also in some measure, by a few brooks below[•]. Scarce a mile below the bridge, the Lake begins to overspread the whole valley; and in half a mile more, gaining in depth from three to ten feet, makes a little creek into Penrôs: from this creek the pool deepens, and from ten becomes twenty-two and twenty-six feet deep, till it is within a furlong and half of the bar, when it rises gradually from twenty-six to ten feet at its brim, being a mile and quarter long, and a furlong wide at a medium. Not being able to proceed farther to the South, the water winds away to the East, and fills Carminow Creek, half a mile long, and half a furlong wide, at a medium. These are the dimensions of the Lo-pool in summer, the superfluous water draining through the bar into the Sea; but in the winter the whole valley is oftentimes spread with

[•] That is, the meeting or coming together of the Lake water, Dôz-mêr-üy.

page 110, says.

[•] Vol. III. page 15.

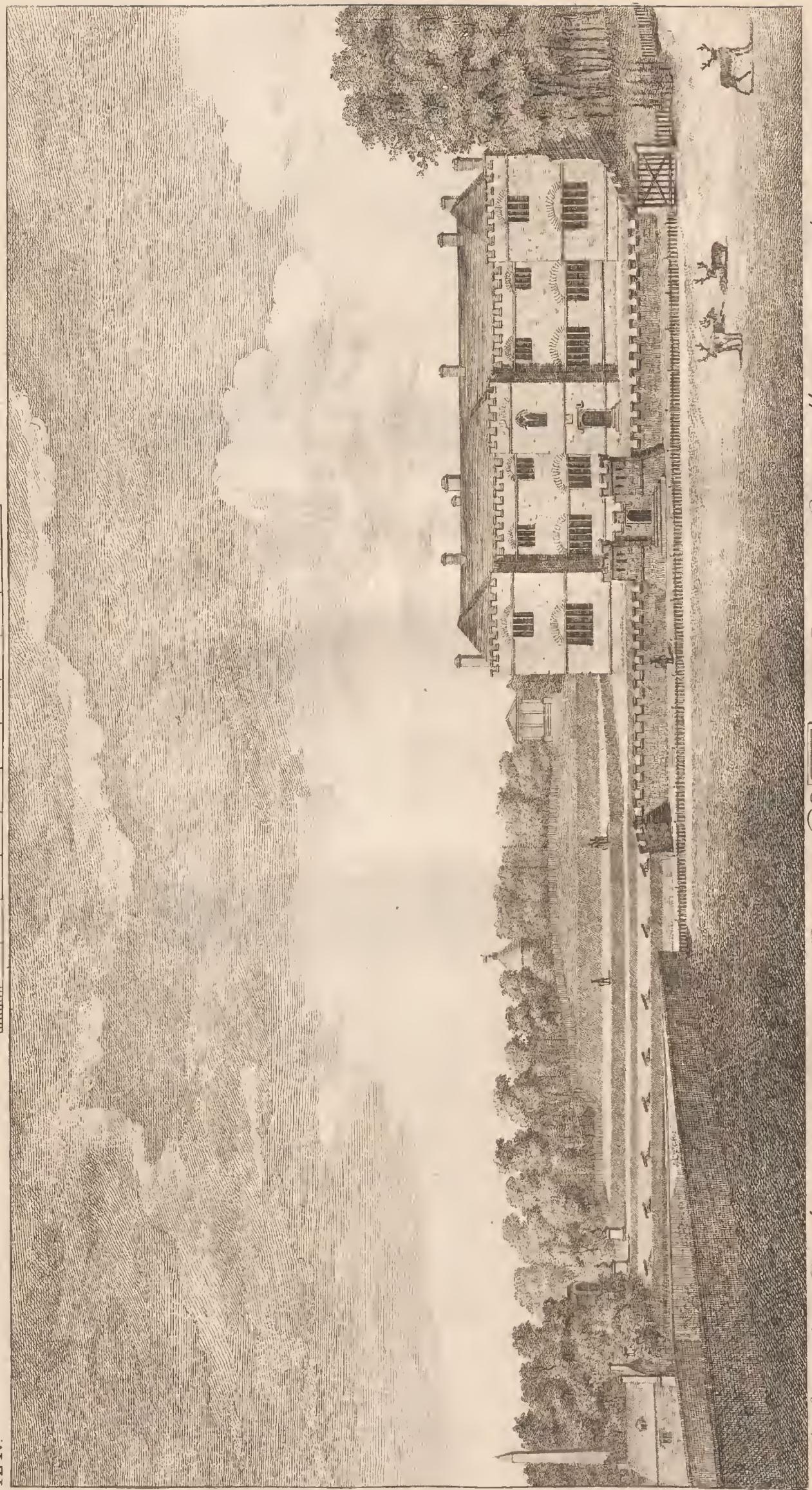
[•] From Penventon and Penrose on the West, and Nansflow, Negybma, and Carminow, on the Eastern banks.

[•] Not the South East, as Leland, Vol. III.

General Scale of feet for the front of the House.

PL. 52.

20 30 40 50 60 70 80 90 100 110.



To Humphry Bridgeman Esq: this Part View of PLACE
near Budston, Cornwall, engravid at his request —
by Wm: Borlase. —
B. & J. 1800.

water from the town of Helston to the brink of the Sea ; and when the town mills at St. John's Bridge have their wheels stopped by this swelling of the Lake, the Mayor of Helston applies himself to the Lord of Penrôs, and on presenting him with a few halfpence in a leather purse, has a right to cut through the bar, that the redundant waters of the Lake may pass away, and the mills be no longer impeded. " If this bar might be always kept open, it would be a goodly haven up to Helston ". The cliffs round this Lake are moderately high, and betwixt them there is a very distinct echo : but the same circumstances which please and amuse in a calm, frighten in a tempest ; and when the South and South West winds from Mount's Bay get in betwixt the steep sides of the Lake, their roaring is heard at a great distance, and thought to presage stormy weather. This Lake is remarkable for an excellent and peculiar trout, which will be taken notice of in its place.

These are all the Lakes we have in Cornwall ; but it is much to be feared, that we shall have more in time, at the two Northern ports ; I mean, Heyl and Padstow : there are sandy bars already crossing their mouths, upon which at neap tides the water is very shallow ; and if a few violent repeated storms should at any time raise those sands above full Sea-mark, (no improbable supposition where sand is in such plenty) throwing in shingle and stones withal, Heyl and Padstow (to the irreparable detriment of Cornwall) will become what the Lo is now.

The Sea-coast spreads itself along the South and North parts of SECT.V.
Cornwall to such a degree, that if we estimate the curvatures of the The Sea of
South and North coast, and make also a just allowance for the much Cornwall.
fewer curvatures of the boundary towards Devonshire, we shall find, that four parts in five of the out-line of Cornwall are exposed to the Sea.

This marine situation has its advantages ; it fills our bays and harbours, makes a number of fishing Creeks, brings its native products, sand, ore-weed, and fish, (as well as foreign merchandize) home to our doors in a multitude of places, exports our tin and fish with great conveniency, its vapours generate and feed our brooks, and soften the air ; its cliffs so near on either hand facilitate the drains of mines ; they also open the treasures of metals, useful earths, and minerals, to the inquisitive eye : in short, the Sea, being on every side of us, procures plenty, and promotes trade and employment in many shapes utterly unknown to the more inland counties. Some circumstances however of this our natural situation have their

* Says Leland, vol. III. page 12.

disadvantages :

disadvantages : our coast is not only extended greatly in proportion to the area of land, but it has many promontories jutting out on each side, which necessarily make deep bays, and unhappily augment the distresses of sailors in stormy weather : another inconvenience of our Sea-situation is, that the land shooting out sharp like a wedge into the Atlantic Ocean, ships oftentimes mistake one channel for another, or are drawn aside from their true course by the inequality of the tides. Farther : The irregularity of the tides rising from the prominence of the head-lands, is also increased, at the extremity of Cornwall, by the Scilly Isles, which narrow the channel (whether the tide sets to the North, or the South); and consequently, increasing the velocity of the current, promote a more than ordinary indraught into both channels. The tide of flood at the Land's End rises on the top of a common spring eighteen feet, and from that to twenty-four, according to wind and weather ; insomuch, that in stormy weather, from the South-West, it has risen to the height of thirty feet ; but at the common neap tides only thirteen feet usually, and at a very dead neap it has not risen above ten feet. During the flood, the tide at the Land's End sets inward from the South near nine hours ; its run is eight hours in most places betwixt Scilly and the Land's End ; but the ebb continues only betwixt three and four hours. This is a very dangerous singularity, if not known, and properly regarded ; but the greatest difficulty of all, which our maritime situation lies under, is this ; that an accurate survey of our shores, and a precise determination of our latitude and longitude, has never yet been taken, not so much as of the Lizherd, the first land usually made by ships homeward bound, and the Southernmost point of England, from which most ships outward-bound to the Southward begin their reckoning : here a false step is made at first setting out, and unless rectified by repeated observations, it may be of fatal consequence. To have the longitude and latitude ascertained at the extremity of the island where ships begin and end their reckonings, is certainly a matter of the greatest moment to commerce, and should be performed by a variety of the best instruments, at subsequent times, and by more than one skilful hand. This has never yet been done, (see before, chap. i.) nor will be probably, but by the interposition of the government, whose attention and nomination of proper persons, and provision of a sufficient apparatus of astronomical instruments, (an expence seldom within the reach of a private purse) this matter, I speak it with submission, seems to me exceedingly to deserve.

Another circumstance claims the attention of our countrymen ; our harbours are generally at the mouths of rivers, and not very distant from the hills where they rise, and of course not so long or
deep

deep as where the rivers and creeks run farther up into the land : they are therefore more apt to be choaked with sands and rubbish than in other situations. Too much care therefore cannot be taken that ships discharge not their ballast in improper places, so as to obstruct the navigable channel, a grievance of which many intelligent traders are apprehensive, as it may affect our Sea-coasts in time, when a remedy may not easily be found out. The highest tide, in equal circumstances, is about two days and a half clear after the new and full moon. The tide is later than at London Bridge one hour and fifty-five minutes. The variation of the needle at the Land's End has for some years been reckoned above eighteen degrees Westerly ; but in the month of October, 1757, at Carelew House, on one of the branches of Falmouth Harbour, it was, by a needle of ten inches and half long, found to be nineteen degrees twelve minutes Westerly. Dr. Halley *, in the year 1700, found it to be no more than seven degrees and a half Westerly ; but whether the increase has been regular and gradual, for want of a continued series of observations, I cannot determine.

Such is the common ordinary state of our Sea in Cornwall, as to tides, creeks, harbours, and charts ; but indeed the tides are greatly accelerated or retarded, not only by the projection of so many head-lands, the depths of bays and creeks, and the indraught of the North and South Channels, but by different winds, and yet the most extraordinary phœnomenon which has ever appeared on these coasts, as far as I can learn, proceeded from neither of these causes. On the 1st of November, 1755, about two o'clock in the afternoon, the Barometer being at the highest I have noted it for three years past, Fahrenheit's Mercurial Thermometer at 54, the fane pointing to the North-East in a flat calm, the Sea, about half an hour after ebb, was observed, at the pier of St. Michael's Mount, to rise suddenly, and then to retire. This attracted the attention of the spectators, and to their great amazement, ten minutes after, the Sea rose near six feet, coming in from the South-East extremely rapid ; it then ebbed away with the same rapidity to the Westward for about ten minutes, till it was near six feet lower than before ; it then returned again, and fell again in the same space of time, and continued the agitation, alternately rising and falling, each retreat and advance nearly of the space of ten minutes, till five hours and a half after it began. During this agitation the Seyn-boats, riding at the head of the pier, were whirled some one way, some another ; and the fishermen endeavouring to bring some boats into the pier, they were hurried in and out of the mouth of the pier, as the

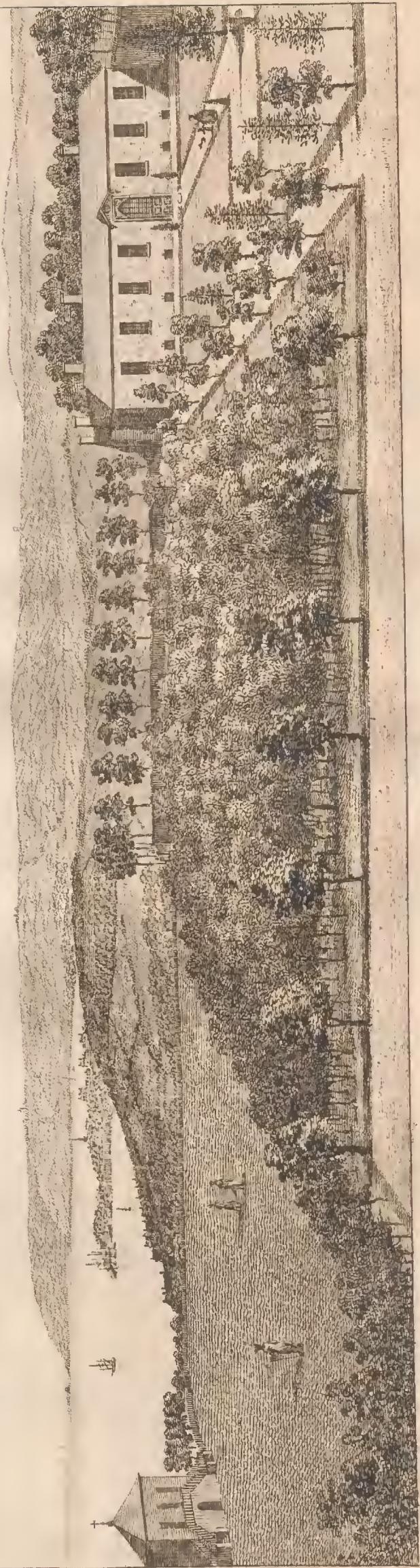
* Letter to the author from Mr. Charles Heydon, Math. instrument-maker, October 3, 1754.

Sea advanced and retired, with an impetuosity not to be resisted ; and yet no life, or boat, or ship was lost. The first and second fluxes and refluxes were not so violent as the third and fourth, at which time the Sea was as rapid as that of a mill-stream descending to an under-shot wheel, and the rebounds of the Sea continued in their full fury for two hours ; they then grew fainter gradually, and the whole commotion ceased about low-water. In Penzance pier, three miles West of the Mount, the tide rose eight feet, and in Newlyn pier, one mile farther West, ten feet high, the water coming from the South-East, being as it were accumulated by the Western head-lands, which form Gwava's Lake near the last-mentioned pier ; but no material damage was done at either place. The same agitation, though somewhat later in the day, was observed in the Northern Channel at the pier of St. Ives, where the highest water rose betwixt eight and nine feet, and in Heyl Harbour adjoining, one rise was seven feet, the rest little more than two^r. All this while there was not the least trembling or motion of the earth perceived in any parts near us ; but on the same day, about ten o'clock in the morning, the most dreadful Earthquake ever known happened on the Western coasts of Portugal and Spain. The city of Lisbon was destroyed, 30,000 persons, some say more, lost their lives, St. Ubes, Sevil, Cadiz, St. Lucar, Oporto, Faro, were greatly damaged, and many lives lost. Ships sixty leagues distant from Lisbon, to the West, felt the shock in the same degree as if they had struck upon rocks. The Tagus rose from ten and twenty to thirty feet perpendicular, ebbing and flowing several times, but every time decreasing ; and between the agitations of the Sea, and the violent shaking of the earth, the desolations of that country are not to be expressed, and have never yet been exactly estimated.

What connexion with or relation to these violent convulsions on the Continent our little, and (thanks to Providence) momentary agitations of the Sea on the coasts of Britain had, 'tis difficult to say ; but their happening both on the same day, and within a few hours of one another, the many repeated fluctuations in the river Tagus as here in Cornwall, by alternate swells and sinkings, the shocks felt on the same day far to the West by several ships ; all these circumstances seem to declare very consistently, that what we felt was either the fainter part of that deplorable shock at Lisbon, or the last expiring efforts of some similar subterraneous struggles farther to the West and South-West under the Atlantic Ocean. Indeed,

^r At Swansea, in Wales, where their tide is later than with us, and the land farther to the North, the agitation, by the accounts published from thence, was some hours later, by which it

is more than probable that the momentum of this unusual agitation had its first rise far to the South of us.



To the Hon. & John Harris Esq: this Eastern Hen
his ex pense is most
gratefully inscribd by

of KENE GY in Mounthay, Cornwall, Engrav'd at
Wm Borlase.

it can scarce be imagined, that a shock, so far off as the coast of Spain, could be so immense as to propagate so violent a motion of the water quite home to the shores of Britain in less than five hours; I should rather think that the same cause, diffused in different portions through the intestines of the earth, produced several subsequent rarefactions of the imprisoned vapours; that these rarefied tumid vapours affected the Seas and land above them in proportion to their own power, the dimensions of the caverns they had to extend themselves in, and the superiour or fainter resistance of the incumbent pressure. But though at this time no motion of the earth was perceived, nor any noise in the air, yet Cornwall can give a recent instance of both.

On Friday the 15th of July, 1757, a violent shock of an Earthquake was felt in the Western parts of Cornwall.

The Thermometer had been higher than usual, and the weather hot or calm, or both, for eight days before; wind East and North-East. On the 14th, in the morning, the wind shifting to the South-West, the weather calm and hazy, there was a shower; the afternoon hazy and fair, wind North-West; the Barometer moderately high, but the Mercury remarkably variable.

On the 15th, in the morning, the wind was fresh at North-West, the atmosphere hazy, being on the sands^z, half a mile East of Penzance, at ten a. m. near low-water, I perceived, on the surface of the sands, a very unusual inequality; for whereas there are seldom any unevennesses there, but what are made by the rippling of the water, I found the sands, for above a hundred yards square, all full of little tubercles (each as large as a moderate mole-hill), and in the middle a black speck on the top, as if something had issued there; between these convexities, were hollow basons of an equal diameter; from one of these hollows, there issued a strong rush of water, about the bigness of a man's wrist, never observed there either before or since.

About a quarter after six, p. m. the sky dusky, the wind being at West North West, fell quite calm; about half past six, being then in the summer-house at Keneggy, the seat of the Honourable J. Harris, Esq; near Penzance, with some company, we were suddenly alarmed with a rumbling noise, as if a coach or waggon had passed near us over an uneven pavement; but the noise was as loud in the beginning and at the end, as in the middle, which neither the sound of thunder or of carriages ever is: the sash casements jarred; one gentleman thought his chair moved under him, and the

^z These sands, when the tide is in, are covered with ten or twelve feet of water; but when the

tide is out, afford an area of three miles long, and about a furlong wide, of smooth, firm sands.

gardener,

gardener, then in the dwelling-house, (about a hundred yards distant from us) felt the stone pavement of the room he was in, move very sensibly.

In what place the shock began, and whether progressive or instantaneous in the several places where it was felt, is uncertain, for want of accurately determining the precise point of time in distant places.

The shock was not equally loud or violent. Its extent was from the isles of Scilly Eastward as far as Liskerd, and towards the North as far as Camelford ; through which district I shall trace it according to the best informations I could procure.

In the island of St. Mary, Scilly, the shock was violent : on the shores of Cornwall, opposite to Scilly, (in the parish of Senan, near the Land's End) the noise was heard like that of a spinning-wheel on a chamber-floor : below stairs, there was a cry that the house was shaking ; and the brass pans and pewter rattled one against another in several houses in the same parish. In the adjoining parish of St. Just, two young men, being then swimming, felt a strong and very unusual agitation of the Sea. In the town of Penzance, in one house the chamber bell rung, in another the pewter plates, placed edgeways on a shelf, shifted, and slid to one end of the shelf ; and it was every-where perceived more or less, according as peoples attention was engaged.

At Trevailer, the Seat of William Veale, Esq; about two miles from Penzance, the noise was heard, and thought at first to be thunder : the windows shook, and the walls of the parlour, where Mr. Veale sat, visibly moved. The jarring of the windows continued near half a minute, but the motion of the walls not quite so long ; and some masons being at work on a contiguous new building, the upright poles of the scaffolds shook so violently, that, for fear of falling, they laid hold on the walls, which, to their still greater surprize, they found agitated in the same manner ; and a person present, who was at London at the time of the two shocks, in the year 1751, thought this shock to resemble the second, both in degree and duration^a.

At Marazion, the next market town East of Penzance, the houses of several persons shook to that degree, that people ran out into the street, lest the houses should fall upon them. In the borough of St. Ives, on the North Sea, six miles North of Penzance, the shock was so violent, that a gentleman, who had been at Lisbon during several shocks, said, that this exceeded all he had met with, except that on the 1st of November, 1755, so fatal to that city.

^a Letter from William Veale, Esq;

At

At Tehidy, the seat of Francis Bassett, Esq; the rooms shook, and the grounds, without doors, were observed to move. The shock was felt sensibly at Redruth, St. Columb, Bodman, &c. along to Camelford, which is about ninety miles from the isles of Scilly. From Marazion, Eastward, it was felt at several places, in like manner, as far as Lostwythyel : but at Liskerd, about ten miles East of Lostwythyel, it was but faintly perceived, and that by a few persons : it was still less sensible at Loo and Plymouth, “ scarcely sufficient to “ excite curiosity or fear ^b. ”

The times of its duration were various. At Keneggy, we thought the noise could not have lasted above six seconds ; at Trevailer, not two miles distant to the West, it was thought to have lasted near half a minute ; in the parish of Gwynier, half a minute ; at Ludgvan, three miles East of Penzance, the noise was rather longer than half a minute ; but the shaking felt in the garden, and observed in the houses, short and momentary. In Germo great-work, seven miles East of Penzance, it lasted only a few seconds ; but in the isles of Scilly, it was computed at forty seconds.

So was this Earthquake felt in towns, houses, and grounds adjacent ; but still more particularly alarming in our mines, where there is less refuge, and consequently a greater dread, from the tremors of the earth.

In Carnorth Adit, in the parish of St. Just, the shock was sensibly felt eighteen fathom deep ; in the mine, called Boscadzhil-downs, more than thirty fathom.

At Huel-rith mine, in the parish of Lannant, people saw the earth move under them, first quick, then in a slower wavy tremor ; and the stage boards of the little winds or shafts, twenty fathom deep, were perceived to move.

In Herland mine, commonly called the Manor, in the parish of Gwynier, the noise was heard fifty-five and sixty fathom deep, as if a studdle ^c had broke, and the deads ^d were set a running : It was nothing like the noise of thunder.

In Chace-water mine, the same noise was heard, at least seventy fathom under the surface.

At Huel-rith mine, near Godolphin, the noise was seemingly underneath. I felt (says the director of the mine) the earth move under me, with a prodigious swift, and apparently horizontal tremor ; its continuance was but for a few seconds of time, not like thunder, but rather a dull, rumbling, even sound, like deads running under ground. In the Smith’s shop the window-leaves shook, and the slating of the house cracked ; the Whim-house shook so

^b Letter from J. Trehawk, Esq;
^c A timber-support of the deads,

^d The loose rubbish and broken stones of the mine.

terribly, that a man there at work ran out of it, concluding it to be falling. Several persons then in the mine, working sixty fathom deep, thought they found the earth about them to move, and heard an uncommon noise: some heard the noise, and felt no tremor; others, working in a mine adjoining, called Huel-Breâg, were so frightened, that they called to their companions above to be drawn up from the bottoms: their moorhouse was shaken, and the padlock of their candle-chest was heard to strike against the staples.--- To shew that this noise proceeded from below, and not from any concussion in the atmosphere above, this very intelligent captain of the mine observes from his own experience, that thunder was never known to affect the air at sixty fathoms deep, even in a single shaft pierced into the hardest stone; much less could it continue the sound through such workings as there are in this mine, impeded in all parts with deads, great quantities of timber, various noises, such as the rattling of chains, friction of wheels and ropes, and dashing of waters; all which must contribute to break the vibrations of the air as they descend: and I entirely agree with this gentleman's conclusion, that thunder, or any other noise from above in the atmosphere, could not be heard at half the depth of this mine. This therefore could be no other than a real tremor of the earth, attended with a noise owing to a current of air and vapour proceeding upwards from the earth.

I do not hear of any person in those parts who was so fortunate as to be near any pool or lake, and had recollection enough to attend to the motion of the waters; but it may be taken for granted, that, during the tremors of the earth, the fluids must be more affected than the solids; nay the waters will apparently be agitated when there is no motion of the earth perceptible, as was the case of our ponds and lake-waters in most parts of Britain, on the 1st of November 1755¹: whence this comes is difficult to say; whether the earth's bosom undergoes at such times a kind of respiration, and alternately emits and withdraws a vapour through its more porous parts sufficient to agitate the waters, yet not sufficient to shake the earth; or whether the earth, during the agitation of the waters, does rock and vacillate, though not so as to be sensible to man, is what I shall leave to future enquiry.

Earthquakes are very rare in Cornwall; this was but of short duration, and did no harm any-where, as far as I can learn; and it is to be hoped not the sooner forgotten for that reason, but rather remembered with all the impressions of gratitude suitable to an incident so alarming and dangerous, and yet so sparing and inoffensive.

¹ Mr. John Nancarrow.

² Philosophical Transactions, 1756.

C H A P. VI.

Of the Earths, viz. the Soils, Clays, and Steatites of Cornwall.

THE vegetable Soils may be distinguished into three sorts, the SECT. I. black and gritty, the shelly flatly Soil, and the stiff reddish Soil, approaching more to the nature of Clay.

The highest grounds are covered with the black Soil, and on the SECT. II. tops and sides of hills, it is so lax and cold, and its salts so dispersed by the rain and snow, that where it is dry at bottom it bears nothing but sour grafs, moss, and heath, which is cut up in thin turfs for firing, or at best, short, dwarf, commonly called Cornish Furze; where the rains have not liberty to run off, bogs (though in Cornwall none dangerous or extensive) and marshes are formed: here the Soil is less gravelly and deeper, but to be rang'd among the black Soils, and of little other use than that it yields a thick brick turf, full of the matted roots of sedge-grafs, the *juncus*, and other marsh-plants, which, when thoroughly dried, make a strong fuel. On the banks of the river Heyl, in the parish of St. Erth, there is a strong close-grained turf, which I have seen cut into glebes, ten inches square, and six deep: they were ranged in the side of a moorhouse^{*} as regularly, and almost as close, as if they had been squared stones, and made, instead of a hedge, a most neat wall, if I may say so, the corners of the ends, doors, and windows, were so well turned. This turf has a stiff, white, compact clay under the spine, which gives it its consistence. In crofts, farther down from the hills, this black Soil serves as wintering for horned cattle, bears good potatoes, rye, and pillas, the *avena nuda* of Ray; in fields, barley and oats, and serves as pasture for dairy and sheep, especially rearing young bullocks; but seldom turns to any account when sown with wheat. It is more or less charged with gravel, and therefore called by the Cornish *grouan* (or gravelly), the earthy parts exceeding light, so that, in a dry summer, the sun quickly exhales its moisture; and, in a wet summer or winter, the tilled grounds of this sort have much of the vegetable Soil washed away from the grain.

A great part of the Cornish Soil, especially about the middle of SECT. III. the County, is of a shelly, flatly earth. This is reckoned to bear Shelly Soil. better corn, especially wheat; as also a stronger spine of grafs than

* A hutt, belonging to a mine, for the shelter of the workmen, and keeping their implements.

the black *grouan*. Several parts of the County have their vegetable Soil of this mould, but more especially those lands which run from Padstow on each side the Alan on the North Sea, to Fawy on the South, and thence to St. German's, from which district the greatest part of this County's corn does proceed. The greatest enemy to this porous soil is drought; for loose as it is, and perpetually dismissing part of its moisture through its shelfy foundation, it will yield the rest to the sun-beams above, after a long intermission of rain, by which means both the grass and corn suffer; but droughts of any continuance are so rare in Cornwall, that the husbandmen in those parts have seldom any reason to complain.

SECT. IV. The reddish, Loamy Soil is of closer texture, consequently retains The Loamy. the moisture of rain, the salts it receives from the higher grounds, the putrified parts of plants and animals, and the bounty of manures, much longer than the Soils above-mentioned: it is not indeed so soon heated and animated (if I may so say) by the sun; but as the spring and warm weather advance, it retains the influence of of the day, notwithstanding the interposition of the night, in some degree, till the day comes on again, and ripens crops much sooner than the blacker and looser Soil. This Soil is most common on level grounds and gentle declivities.

These three sorts of Soil are not always equally and specifically distinct from each other, but in different places are so mixed, that the black partakes more or less of the red, the red of the black, and the flat of either, or both; neither are they found always in separate peculiar tracts, but oftentimes so interlaced, that one, viz. the higher part of a tenement or barton, shall be of one Soil, and the lower and more champagne of a quite different. The attentive husbandman will easily distinguish them, and the discreet and industrious will appropriate to each of them its proper culture. To the black and flattish Soils, stiff, earthy, and calcareous manure, such as may warm, strengthen, and consolidate; but to the red and Loamy, every kind of manure that may loosen, quicken, and open it. Their management therefore must be different, and the product and fertility, *caeteris paribus*, will be in proportion to the depth of the soil, and as the bottom on which that Soil rests contributes to remedy and counteract the natural defects of the Soil above: if the loose soil has a close clay bottom, this latter will retain the necessary moisture; and if the denser and more compact Soils have a shelfy, open bottom, this will further its fertility by draining off the superfluous moisture below. As to the rest, circumstances will vary without end, and beyond rule; and where theory cannot reach, experience will decide.

Dr.

Dr. Plot^h is fond of attributing the fertility of earth to the warm SECT. V.
streams arising from metals and minerals below; but the sterility Of Fertility.
may be great, where metals and minerals abound, of which no place
in general.
perhaps affords more frequent instances than Cornwall; for here the
coarsest grounds abound most in metals, and on the other hand,
there is the greatest plenty of corn, grafts, plants and trees, where
no metals or minerals have ever appeared.

To assign any one general cause of the fertility of the earth, would be to build upon too narrow a bottom; one of the greatest prodigies of nature is, that earth should assume so many shapes, and nourish, and constitute such a variety of bodies: we know by experience, that many materials must concur, and that some are more prolific than others, but by what process, earth is transformed into nourishment, we cannot so much as guess. Earth is the general food and *stamen* of all bodies, yet of itself we know it can do nothing; it must be connected by a cement, or it cannot form stone; it must be softened and attenuated by moisture and warmth, or it cannot enter into the alimentary vessels of plants and animals. By experiment indeed, it appears, that the consumption of that Earth, in which trees are planted, is not great, nor at all proportionable to the perspiration and increasing bulk of those treesⁱ; yet must not Earth be denied its due share in vegetation; the parts of Earth which constitute the solids of any plants are extremely fine, and all the water we pour, or rain that falls on plants, is well stocked with those fine, earthy parts, now the common mass in which we plant trees, is for the most part Gravel, Clay, and Sand, which promote vegetation, but are too gross to enter into, and become the constituent parts of plants, and therefore cannot much decrease in weight or bulk: water must therefore be considered as the vehicle of more solid nourishment, and the parent of the fluids: the earths, salts, and oils, are the great instruments of the increase of solids. To trace fertility a little farther: When the earth is softened and diluted, heat rarefies and evaporates the mixture; the salts contained and dissolved, are always active, and promote motion; the elasticity of the air quickens and continues it; the oils supple the passages, of which some are fitted to secrete, arrest, and deposit the nutritious particles as they pass; some adapted (by the same secret hand which conducts every part of the operation) to throw off the redundant moisture by perspiration: the more earthy mixture composes the hard and solid parts, and the genial, little atmosphere of every plant gives spirit, colour, odour, and taste. Herbs and fruit, being thus fed and matured, make the earth they contain better pre-

^h Oxfordshire, page 57, 58, &c.

ⁱ Dr. Hales's Vegetable Statics.

pared to pass into the still more curious and highly organized parts of animals. It is easy to see that this is rather a detail of the several materials and well-known instruments conducing to fertility, than the cause; fertility is owing to the concert, fitness, and agreement of all these (with perhaps some volatile, active principle, of which we know nothing at all); but whence that agreement does result, how the materials ferment, replace, connect, and invigorate one another, how the vessels chuse and refuse (if I may say so) in order to produce the fertility desired, is known only to the infinitely wise Disposer of all things, ever attentive to the nurture and support of what he has created.

But to whatever cause the fertility of Earth is to be assigned, Earth, it must be owned, is a most fruitful, universal element; animals, plants, metals, and stones, arise out of it, and return to it again; there, as it were, to receive a new existence, and form new combinations; the ruins and dissolution of one sort affording still more and more apt materials for the more plentiful production of others: in stones and metals, we admire the continuity, hardness, and lustre of Earth; in plants, the softness, variety, colours, and odour; in animals, the flesh, the bone, and yet an infinite number of different fluids, in which this supple element can take place; but the greatest wonder is, that Earth is capable of being subtilized to such an exquisite degree, as by uniting and communicating with spirit to perform all animal functions given in charge to it by the soul. This is the highest and utmost refinement which, in this state of being, Earth is capable of; but that it may be still farther refined, in order to be qualified for a future, incorruptible, and more glorious state, is one of the great truths which we owe to Revelation.

SECT. VII. In our mines, we often find the Ochrous Earths of metals, the *Ocres, Chalk, and brown Earth.* rusty Ochre of iron, which we, in Cornwall, call *Goffan*, the green and blue Ochres of copper, the pale yellow Ochre of lead^k, the brown yellow of tin, and the red Ochre of Bismuth; these Earths we call the feeders of the metals they belong to, and where they are found, the metals are generally, and very justly reckoned not to be far off. Chalk is scarcely yet discovered any where in Cornwall, but I have such a sample by me (though of a coarse gritt), brought from the parish of St. Clare, as may convince us that more may be found than is imagined upon a diligent search; a lump of smooth Earth, brought me from the parish of Illogan, of a chocolate colour, was

^k I have some lumps of this from Gwynier downs, which, in its natural state, mixes well with oil, and makes a shade betwixt the common light and brown Ochre; neither so bright as the former, nor so ruddy and warm as the latter;

but more upon the pink. This therefore might probably be introduced into painting with advantage, as it is solid, and will not fly off (as the painters say) as the brown pink, being a transparent colour, will.

speckled

speckled in and throughout with a bright yellow Ochre, and a little cineritious Clay : in water it would not dissolve, nor remain suspended but for a few minutes ; when wetted, stuck fast to, and coloured the fingers : I then ground it on a stone with fair water, and it made as good warm *bezo* for drawing as that made of the ashes of the vine branch, giving a fine sooty colour to paper. After this I ground it with linseed oil, and upon laying it thick on the canvas, I found it mixed well with white, not at all cracking or flying off, and that it made a colour equal, and even superior to burnt-umber, which, though a necessary colour in painting, is very raw, harsh, and corrosive, and requires much skill to soften and correct its asperities ; and I am apt to think, that this natural Earth may with great success be substituted in its room ; when cast into the fire, this earth made no more crackling than might be expected from the air inclosed in a porous body : sprinkled on a red-hot iron, it emitted no ill smell : keeping it in the fire till it was red-hot, it was not affected by the magnet, either then or before ; but seeming to have acquired a little redness, I wetted it with water, yet found it still to retain its *bezo* and brown-umber colour. With aqua fortis it made not the least effervescence. I never saw but one lump of it : it is certainly a valuable earth for painting in oil, as well as in water-colours.

There are strata of clay for making bricks in so many places, SECT. VIII.
that there is hardly a parish, seldom a large tenement without it, Clays.
though more generally found in the low and level lands than in the hilly, and not so often near the flatty Soil as the loamy. Of white clays in Cornwall we have great quantities, and some very useful. The following are the most remarkable which have reached my notice : A white clay there is found in the parish of St. Agnes, which has been used for making tobacco-pipes ; but either not proving so good, or not so easily procured, (as it must come from thence by land-carriage) it is at present disused ; and in the Western towns, where they make great quantities of pipes, the clay is brought from Pool, in Dorsetshire.

In the tenement of Amalebreh, in the parish of Tewidnek¹, twenty feet under the surface, there is a *stratum* of white clay. Immersed in fair water, it imbibed the water so greedily, that it made a hissing effervescence, dissolved easily into a paste, and the water became like milk ; after stirring, the sand mixed with the clay subsided, leaving three eighths of the glebe suspended in the water. The larger sands or gravels were transparent, about the bigness of a

¹ That is, belonging to St. Ewine.

pepper-corn, and plainly a congeries of smaller crystals cemented together into a lump: their angles were somewhat blunted, but the smaller gravels or sands were quite angular; mixed with the gravel, was a good deal of leafy talc, which, in the microscope, appeared as so many *laminæ* of crystal. The three eighths suspended in the water, and left to settle, deposited an exceeding white clay; it whitens the fingers, sticks to the tongue, is extremely smooth to the touch, tasteless, a little gritty between the teeth, owing to the smaller grains of talc, which never deserted the Clay during the depuration. Being of so fair a colour, I ground some of it with nut oil, but it lost its whiteness, and became fat, and of a dove colour: with linseed oil it grew much more yellow, so that it will not, as a colour, be fit for painters; with aqua fortis it makes not the least effervescence, but resolves into a paste; put into a fierce fire, and kept there four hours and forty minutes, it neither vitrified nor altered its colour, and acquired no more hardness than is necessary for pastils for drawing. As this Clay separates so easily from its sand, has much talc, (and therefore will not vitrify) and the purest colour, it may possibly, both without as well as with its sand, upon different occasions, be a very useful ingredient for making porcelain; at present, in its natural state, it serves only to make bricks for smelting-houses, enduring the most intense fire of the furnace better than any other within equal reach of the workmen. By its dissolving so readily in water, it may be a kind of marle, and useful as a manure.

Sect. IX. There is a *stratum* of clay not very different from the foregoing in the tenement of Trewren, in the parish of Madern: it resists the fire well, and is used by the melters for the same purpose as that above, but is not near so white, smooth, and soft; by burning a small quantity of it, it appears more tenacious, and fitter for stone and potters ware, being reduced into a very hard clome by my study fire. There are many other whitish Clays^m in Cornwall of much the same nature as those already mentioned. I have only to remark, that in the heart of the bed of clay found at Amelebreh, there are some scattered stony glebes of red earth, like the Rubrica of Pliny, and the Miltos of the Greeks. I immersed this ruddle in water, but it would not dissolve: upon grinding it, the stony part was hard and gravelly, but being well ground down with clarified linseed oil, it made a very good red, and mixed kindly with white, making a good flesh colour, and though laid on thick on the canvas, would not start, nor alter its colour; so that a better

^m As at Tregonin Hill in Breag, at Treaffo in Ludgvan, in the parish of St. Endor, and near the town of Lostwythel, &c.

red; for all the purposes of red Ochre, cannot well be expected to come from the ground. It may seem somewhat strange that glebes of Earth, of so red a colour, should be found scattered in a body of clay so white and pure; but nature, as well under ground as above, is still various; and the more we prosecute our researches, the more subjects we may expect to meet with which will excite our admiration, and convince us of our ignorance. One thing however may be observed, that these red and white clays are very different in nature as well as colour; one, viz. the red, mixing well with oil, and not with water; the other, as greedily imbibing water, and not enduring oil. If these so different substances therefore are now found in their original beds, as is most likely, the red must have been repelled on all sides by the white, and compacted together by the attraction of its own similar parts.

In the parish of St. Kevran there is a yellow clay, which, for SECT. X. casting silver, brass, or lead, is reckoned to exceed every thing of ^{St. Kevran} Clay. its kind in these parts.

In the parish of Lannant there is a yellow clay much coveted for SECT. XI. building furnaces: 'tis carried off to Bristol and Wales, and other ^{Lannant} Clay. places, in such quantities every year, that Humphry Mackworth Praed, Esq; owner of the Soil, makes above 100 pounds *per annum* of this clay, *communibus annis*; and from January 1757, to Midsummer following, received for it 150 pounds. Bricks made of this clay melt and vitrify in the fire, running into one solid body; but afterwards never stir till quite calcined, enduring the most intense fire beyond any bricks used for like purposes.

There is a yellow sandy clay in the Vorlas, near the Long Bridge, SECT. XII. in the parish of Ludgvan, good for bricks and plaster; and in some ^{Ludgvan} Clay. parts of the same pit, a fine blue clay, which, being well mixed with white, (such as the Amalebreh before-mentioned) makes an excellent lute for assaying. This blue clay vitrifies presently, but the white will scarce vitrify at all; neither of these clays is therefore proper for luting the crucible separately taken, but mixed they correct one another, and there is no better composition for the assay furnace.

Near the borough of Liskeard there is found in great plenty a SECT. XIII. yellow flatty clay of a fine earth; it feels and cuts smooth, and with a ^{Liskeard} Clay. good polish, and the colour was as fine to the eye as the Naples yellow*; but, upon tryal, it would not mix with oil; it grew fat and greasy; it is therefore a steatites. It is good for grafts; for a gentleman

* A light beautiful yellow earth, much esteemed in painting.

gentleman having made a walk, and laid this clay as a cement, found the gras to grow most plentifully: it might prove perhaps, upon farther tryal, a marle, as proper for corn as gras; but the usefulness of marle is little known in Cornwall.

SECT. XIV. There is a white steatites*, in the parish of Guenap, of a more indurated Earth than the former: but the most curious of all our clays in Cornwall, is the steatites near the Lizherd, generally called the Soap-rock. As the situation of this curious fossil, and its position in the Earth, has been wholly mistaken^o, I shall be the more particular as to the place and other circumstances. The first place where it appears, is at Kynans Cove, one mile and half North-West of the Lizherd: here is very little of the steatites, and so far are the cliffs from being composed of it, that it was with difficulty we found any; but 'tis rare to find a place where a Naturalist would have been more delighted, if he had found none. The way down from the hill is extremely rough and narrow, there being but a path of few inches tread, made by the horses which carry sand; from this path you enter a most lonely cove, the sand of which is of a mixed colour, partly light-blue, partly glittering. These sands are dispersed in many turning and winding passages among rocks and vast masses of cliff, which the sea has unfooted and separated from the high-lands adjoining. The sandy walks lead to many grotts, which are polished too often by the tides to afford any cavernous plants; but at the foot of the rocks, many basons or baths of crystal water are formed in the sands by the eddy of the waves. There is sprinkled in some places a smooth *unctuous* incrustation, much like bees-wax to the eye and touch, of which the crevices in the rocks (generally no wider than the twentieth of an inch) are full. This incrustation does not appear to be any exudation through the pores of the rock, but rather washed out of the crevices, and returned by the waves, till it sticks fast, and forms a kind of enamel upon the sides of the rocks. On the Eastern side of this cove, the rocks in general are more gritty and crumbling, and between them some few and small veins of the white and red marbled clay, one sort of that which we call Soap-rock. But the purest and greatest plenty of the steatites is about a mile farther to the North, where descending into a narrow valley, about 200 paces from the top of the hill, we found, on our left-hand, a straw-coloured, soft, greasy clay, mixed with brown-red, laid bare by the tumbling-down of the green sod which covered it. This course of clay was about a yard thick, easily cut

* Steatites is a clay called so from its resemblance to tallow; in Greek, *σταγός*.

^o "A considerable part of the cliff, near the "Lizard-point, consists of this earth." Wood-

ward's Cat. vol. I. page 6. "The cliff of the "Lizard-point is almost wholly composed of it, "and the adjacent little islands abound with it." Hill's Hist. of Fossils, page 22.

by a knife, and compressed by the hand ; as we walked a few yards farther down, the left hand cliff became a perpendicular solid face of black hard stone, at the foot of which was a channel or vein about eight feet over, of the steatites, of different colours, milk-white, straw coloured, and veined with green, ruddy, and purple. There are also in this wide course, several stony substances, of no affinity to the steatites : as we came farther down, and nearer to the level of the sea, we observed the vein of steatites, contracted into a course fourteen inches wide, but of more uniform consistence, the solid rock making a smooth wall for it on either side : there is a small vein or two more in the side of this cliff, and the several sorts of steatites, contained in all the veins, which I have examined here, and at the forementioned cove are as follow :

N°. I. The pure white, is a close-grain'd glossy clay, dissolves soon in water, is tasteless, sticks a little to the tongue, deposits a yellowish pulpy settlement at the bottom, above which a cloud of the finest parts continues suspended ; mixed with oil, it becomes greasy ; 'tis also too fat to make a body of colour for painting in water, and makes no effervescence with aqua fortis. It is very absorbent, and takes spots out of silk, without injuring the colour, and is possibly the same, which Bishop Pontoppidan calls the "white Talc-stone, " of such a whiteness, that it is used in Norway for powder, as it "may be pulverized into an impalpable fineness." This is carefully selected from the other sorts of clay, barrelled up, and almost wholly engrossed, by people employed under the managers of the porcelain manufactures.

N°. II. A white, dry, chalky earth, sticks strongly to the tongue, tasteless, dissolves easily in water into a pulp, with acids makes no effervescence.

N°. III. The same chalky earth equally mixed with a red earth ; its water ruddy, like red chalk ; its deposit more gritty than the foregoing : makes no effervescence with acids.

N°. IV. The next sort of this clay is very white, clouded here and there, but not veined, with purple. It dissolves in water with more difficulty than N°. I. and tinges the water with purple ; as to the rest agreeing in all its properties with N°. I. This is probably the *cimolia purpurascens*, or *ad purpurissum inclinans* of Pliny, lib. xxxv. chap. xvii.

N°. V. A glossy, pearl-coloured, hard clay, approaching nearly to the consistence of a white opaque spar ; soon cleaves itself into granules when immersed in water, yet dissolves no farther ; but with water grinds soon into a flesh-coloured milky pulp : 'tis much harder than soap and wax, saws free and greasy ; there is a more stony variety of this

SECT. XV.
Different
sorts of Stea-
ties.

this clay, and more speckled with purple, so that you can scarce break it with a hammer; and I find that the more there is of the purple in any sample, the more hard, and less ready to dissolve in water. But the most curious of this sort, which I have seen, was discovered here in 1755; it is of a texture so close and fine, that after it is cut or scraped, it remains as smooth, and of as high a polish, as the best porcelain does after it is burnt. It has an incrustation of green amianthos on the side of the lode, which in my specimen was the twelfth part of an inch thick; and is the most beautiful fossil of this kind I have seen. This may be the Galactites of the ancients, at least it is much of the same nature.

N°. VI. A fat mass of steatites, its coat or skin about half an inch thick, of a waxen texture, of a brown-yellow or deep amber colour, it's interior strong purple, interlaced with a paler, more cinereous purple, the whole veined with a whitish steatites, exactly as to the exterior, like the purple Plymouth marble; it dissolves into a pulp sooner than the foregoing number.

N°. VII. In the lode (or vein), near the top of the cliff, I find a kind of green gritty chalk, which may be compressed with the grasp of the hand, divides in water easily, and dissolves into a clammy pulp. In the more regular and contracted lode below, I find the green making a stony course of about an inch wide, its taste brackish; immersed in water, it divides into angular granules; it is the most solid and hardest of any yet mentioned, whence I conclude that the green steatites, which is tender, gritty, and pulpy above, becomes more compact in the contracted vein below; its parts attracting one another more forcibly where they have not room to spread into a loose incoherent state, consequently the narrower the mold, cleft, or vein, the more close, hard, and stony the included substance becomes; and if this stone proves harder still underneath, as is not unlikely, it will thereby become the more valuable^o.

N°. VIII. A deeper purple, and more stony steatites, from the same cliffs; but whether from the principal lode, uncertain. It has so much of the nature of stone, that it does not swell, nor decompose in water, as the foregoing numbers. Being so stony, I tried to get a good colour from it by grinding it in oil; it was very difficult to bruise, but when ground fine was too greasy for painting.

N°. IX. A blackish kind of steatites, the vein about an inch thick, it's exterior smooth and glossy, it's interior veined and spotted with N°. V, its texture close, corneous, and approaching in the main to a dark flint, and as hard as flint it was to grind, but it will not give fire with steel; being ground down it became of a good

^o This sort approaches very near to the Moroch-tus of the ancients, Hill's Catalogue, page 22,

N°. XII. Perhaps it is some of the green Amianthos.

burnt

burnt umber colour, but, like the rest, too fat for painting. This is however much coveted, and barrelled up for London, the reasons concealed, but for the porcelain likely, or glass manufacture, or both. In the same vein there is a small course of real spar (very unusual in our Cornish lodes) about three fourths of an inch thick, N° X. This spar lies not in a solid lode, but in a shattery tessellated state, like so many dies, loose and side by side; it ferments immediately with aqua fortis; is subtransparent, and breaks into quadrangular prisms, the base a Rhombus.

These are all the sorts of this fossil, which I have discovered near the Lizherd, and in Cornwall we call the products of all these veins Soap-rock, and though the tender clays can with no propriety be called so, yet indeed, the three last sorts may be as properly termed so as steatites, they having no more of suet in them than they have of soap. Both names are equally founded upon the exterior.

Of this fossil learned men have thought differently, and given us very different accounts, owing, as I should think, to their not being sufficiently furnished at one and the same time with the various sorts which these cliffs afford. Dr. Grew, in his *Musæum, R. S.* page 321, seems to have had before him only N° VI. which has indeed all the colours, white, red, purple, and green, (the purple predominant) is hard as suet, and has striated fibres, like the Amianthos.

Dr. Woodward, in his Catalogue of Fossils, vol. I. page 6. has faintly described N° IV. VI. VIII. but it must not be denied, that he first recommends, at least as far as I have seen, this fossil earth for the porcelain manufacture^p. Dr. Hill (*Natural History of Fossils*, page 22) has more fully noted the properties of the last-mentioned numbers, but seems to have had none of the rest in his reach, as is evident by his giving the general name of *Cimolia purpurascens*; whereas several varieties have not the least purple tincture. Another learned Naturalist thinks he can prove it to be the Parætonium of Pliny, (lib. xxxiii chap. 5) not the *Cimolia*, and indeed it is most likely that the white and purest N° I. may be the Parætonium; but I do not, I must own, see the use of disputing, what was the *Cimolia*, or any other earth, clay, or stone of the ancients, for it is well known, that one ingredient, or property either quite omitted, or not well characterised, will throw us into an uncertainty whether things are the same or not; besides, the descriptions of the ancients are not always so well understood (if they were at first accurate) as to be decisive, and in climates and ages so distant, many things may appear to be like, which are essentially much otherwise. Such disputes

^p Ibid.

therefore, may be of consequence to modern systems, but to real natural knowledge, of very little importance ; for if such earths are not the same with those described by the ancients, this will not discourage the moderns from experiments upon all specious, likely earths ; and if they really are the same, yet literary descriptions are so easily mistaken, that no cautious physician, skilful painter, dyer, polisher, or other artist, will apply those earths, clays, or stone, to the uses assigned by the ancients, without making such particular and accurate tryals of those substances as they may depend upon.

SECT. XVI. As to the uses of this steatites, that it is absorbent, and takes spots from cloth and silk, has been already mentioned in the account of N°. I. and if the other harder sorts of it were pulverised and reduced to a paste, is doubtless true of all : but this is not owing to any soap in its composition ; for as it has neither oil nor salt^a, it can be no soap : it is owing to the attraction of its parts, which will imbibe grease, oil, and unctuous mixtures, in the same manner as Fuller's earth, when it cleans stuffs and woollen cloth of the like impurities. It is very good for polishing.

Soap-earth is in great esteem in the bagnios of Barbary for cleansing and softening the skin ; but whether found in veins, or in a more dispersed state, this learned gentleman^b has not mentioned.

Near Smyrna there is a fine whitish soap-earth, which bubbles up, and boils out of the ground an inch or two thick above the surface. Of this earth, boiled with oil, they make, at Smyrna, soap in great quantities, annually employing 10,000 kintals of oil in that manufacture, and a thousand camels every day in carrying off this soap-earth : but I would observe, that if our earth could answer the same purpose (for, though it is not soap, it may prove a proper ingredient for making it) we have not oil in plenty sufficient for such a manufacture. The principal property of our soap-earth is, that it withstands the fire in a wonderful manner ; and though, when taken out of its bed, it appears in so many different colours, yet the scrapings of every kind (excepting the most stony numbers, VII. VIII. IX.) are white, glossy, and transparent, and become whiter still in the fire ; it is owing to the different portions of talc and amianthos which it contains, that this earth prevents vitrification, and makes porcelain ware more tough and tenacious. But what are the particular effects of fire on this clay, and how the sorts are to be mixed, can only be learnt from long and daily attendance at the fires ; and the makers of porcelain ware must be much better skilled in this, than a few trials can possibly make the best assayer. I will

^a Letter from Dr. Gronovius of Leyden to the author, in 1737.

^b Shaw, Trav. page 236.

only

only observe, that if these veins of the steatites were dug deeper, and searched more effectually, the stony sorts might be found in larger masses, and not so shattery as they are now, (and most other stones indeed are near the surface) if so, they would make very pretty vases, &c. at a small expence: in particular, N°. V. would make a fine substance for small busts and heads; and the green stone, N°. VII, might yield a kind of serpentine marble at a proper depth, it being in some parts of the cliff exceeding hard, and not near of so firm a consistence any where above, as it is some fathoms lower down in the vein⁵.

That this, as well as other clays, is streaked and variegated, is owing to the mixture and insinuation of differently coloured, moistened and dissolved portions of earth. Hence the various colours of veined marble, colours inserted, during the liquefient state of marbles, by the concourse of differently shaded earths. Some are fond of attributing the different streaks in clays to some mineral underneath, which sends up its steams, and so changes and impregnates the clay⁶; but if these streaks do not exhibit any proof of a mineral impregnation, as I imagine they oftentimes do not, then these variegations cannot be owing to the cause assigned; and indeed, even where these streaks appear to be impregnated, I should rather chuse to attribute the alteration to the mineral or metallic particles brought downwards by rain or brook, than upwards by steam; for though mineral steams will rise into the air and water, and the vacuities of stone, yet this ascent cannot be copious enough to impregnate bodies of clay ten, twenty, and thirty fathom deep: the truth is, we cannot always say what particular colours are primarily owing to; but we find by experiment, that portions of different coloured earth, reduced to a thin paste, poured gently into one vessel at different times, will produce veins and eddies in clay; and doubtless the same process gave the streaks to clays and marbles.

C H A P. VII.

Of the Sands in Cornwall.

CO R N W A L L, surrounded as it is on the South, West, and ^{SECT. I.} North, by the Sea, has perhaps a greater variety of sea-sands ^{Sands, the} than any County in Great Britain; so many sandy coves it has on ^{sorts and} origine.

⁵ Since my writing the above, I find the following passage in Bishop Pontoppidan's Natural History of Norway, Part i. " Of the dark-green talc, which is likewise used for casting variety of figures, I have seen images, and other kinds of sculpture with as fine a polish, and in every

" respect as slighty, as if of marble or serpentine; yet the latter would have taken up thrice the labour and time, for the talc stone, especially of a good kind is worked much easier than wood itself."

⁶ Dr. Plot, Oxfordshire, page 58, &c.

every

every side, and the sands generally different from one another : but before we come to examine the sands in Cornwall, their varieties, and the uses they are put to there, some particulars relating to sand in general, it's origin, shape, and places where we find it, will deserve our enquiry.

By sand we mean a loose incoherent congeries of pebbles, of no certain uniform size or figure ; transparent more or less, of various colours, usually turning red in common fire, and in strong fire reducible into glass.

SECT. II. I shall consider sands either as natural or factitious.

Natural. By natural sands I mean those, which have been in the same, or nearly the same state from the creation, diffused through all parts of the earth. Sand viewed in a microscope is no more than a parcel of little stones, doubtless therefore they must have begun to exist, and been formed by the same laws that stones were formed by ; now stones were formed at first into hard solid masses, in proportion to the quantity of similar materials and proper cement, and as they were divided more or less by dissimilar adjacent bodies ; where there was a great quantity of lapideous particles and few heterogeneous mixtures, there strata, rocks, and large stones were formed ; but where the lapideous particles were more scattered and disunited by the intervention of other bodies, there small rubble, stones, gravel, gritts, and the smallest and most numerous of all stones, sand, did coalesce into those minute glebes which we at present find them in. This probably was the process in every part of the earth ; so that sand is one of the primeval bodies, concreted at the same time with stones upon the highest mountains, as well as in the valleys, and at the bottom of the sea, as well as upon dry land. Without question, these minute portions of stone, which we call sand, were at first of as different textures, hardness and softness, as the rest of stones, and from the same cause ; but those of a soft and tender substance, became, in process of time, resolved into their earths, whilst those of a firmer structure, such as spar, flint, and crystal, subsist to this very day, and are the present sands and gritts.

SECT. III.
Factitious
sand.

Besides this natural sand, there is also a factitious one, which owes its origin to the fretting of river or sea-water ; for water, always in motion, preys upon the stones, and grinds them by degrees into that stony powder which we call sand : hence it is that the sand of a particular shore, cove, or bay, has generally the same colour, and in a microscope the same structure as the rocks and stones of the adjacent cliffs, and the strata under the sea, upon which the waves are perpetually working, and driving in to the shore what they dash off

from

from those strata. Hence the sands at Ch'andour creek, near Penzance, and thence to Marazion, are of a pale-blue colour, like the rocks at Ch'andour, and the shingle on the strand ; and on the islands of Scilly, it is a bright-coloured shining sand, made for the most part of the talc and crystals of that granite, commonly called Moorstone, which edges all these islands ; and the same may be said of most other parts of Cornwall, where we have sands, reddish, yellow, bright and blue, according as stones of each particular hue prevail in the lands adjoining. This factitious sand is so like the natural, that it is extremely difficult to distinguish them one from another ; and it is very likely, that they may have been so mixed at the time of the Deluge, that the factitious is often taken for the natural at land, and the natural as erroneously reckoned among the factitious on the banks of rivers, and on the shores of the sea.

In sands there is no uniformity of shape : every sort consists of particular sands of various shapes ; some round, some angular, some nodulous ; nay, what is more extraordinary, the sea-sand, which may be said to be in perpetual motion, has, notwithstanding this, innumerable little angular points, as if it had never been in the sea at all ; and the sands about London, and in Northamptonshire, Oxfordshire, and the midland counties, have abundance of particles almost globular, which would make one believe, that they had suffered the agitation of the sea. Having compared a small kind of moorstone sand, found among the white clay of Amalebreh ^{*}, three miles from any sea, with the sea-sand of Scilly, I rather thought the land-sand more angular than that of the sea, and it felt rougher ; but the difference in the microscope was inconsiderable ; so that the difference in shape, betwixt sands of the same size, is not decisive or characteristic : the truth is, the smaller the sand, the more it escapes the trituration of the waters, and the purer and harder the crystal is of which the parts are composed, the less is the attrition, and *vice versa*. Upon viewing the larger sort of Amalebreh sands, I find them full of little angular processes forming grits, which do not appear to have undergone any diminution ; but upon viewing the larger sea-sands, their extremities are all obtuse, plainly manifesting, that they have been rounded by the force of waters. As to the oval and globular sands, found at land, whatever cause it was that formed flints and pebbles into a round or nodulous figure (which, in the chapter of the formation of stones, we shall more properly enquire into) formed also the same figure of those sands which we find at a great distance from the sea and rivers.

* Mentioned before, page 63.

SECT. V. But the uncertainty arising from the shape of sands is still increased by the variety of places in which we find them, and the different manners in which they are disposed in their several places. There is scarce any vegetable soil or clay but has its portion of sand, hardly a gravel-pit, though in ever so inland a country, but has sand in it: many strata of stone have some sand above them. Great part of the bottom of the sea is covered with sand; the shore is fringed with it, especially where the brim of the sea is shallow, and the strand does not dip too fast: and some countries, not only on the borders of the sea, but whole regions, for some hundreds of miles, have nothing but this dreary covering *, and are therefore called the Desarts. We find it also in courses and strata sometimes; but what is most surprizing of all, we find those sands, which undoubtedly came from the sea, in strata or layers on the tops of the highest hills. The question, well worthy of every Naturalist's enquiry, is, How sands came to be so universally and yet so irregularly disposed? I shall confine myself to the most remarkable appearances of sand in this county. Sand, in our vegetable soil and clay, is common every where, and may be reckoned among natural sands. In Cornwall the natural sea-sand is found in much more plenty in the north chanel, than in the South: from the mouth of Heyl, in Penwith, along to Bude-haven, Cornwall has lost a great deal of arable ground on the Northern coast by means of the blown sea-sand, which is still increasing in the parishes of St. Ives Lannant, Philac, Gwythien, St. Agnes, Piran Sand, Carantoc, Cuthbert, Padstow, and the sand spreads every where but where the height of the cliff protects the lands from its invasion. On the South we have no lands over-run by the sand; so that either a greater quantity of it is lodged by nature in the north chanel than in the South, (one part of the bottom of the sea being as naturally liable to be more sandy as to be more rocky than another) or the river Severn brings down, with its muddy waters, a great quantity of earth and natural sand; the earth is dissipated, or rests in sheltered beds, the sand is driven by tide and wind upon the shores, and thence upon the land. In the South chanel there is no such quantity, or at least such a continual accretion of sand; and therefore no such desolation.

SECT. VI. Of Sands on the sea-shore, some are always quick and dangerous, Some quick,
and why. some are only occasionally so. Those sands which are always sinking and unsafe to tread on, consist of a layer of sand spread on the tops

* As in Arabia, Lybia, &c.

of bogs^x; and where this covering is thin, the sands are dangerous in proportion to the depth of the bogs underneath. Where the sands are only quick at particular times, as at Heyl in Penwith, and on the strand betwixt Penzance and Marazion, and elsewhere, the alteration is owing to wind and sea: in calm weather, sands settle, grow firm and compact; but a violent stormy sea will stir and shift the *stratum* of sand, condense and accumulate it in some places, and in others leave the *stratum* so rare and diluted, that it cannot bear the weight of man or horse, which must therefore sink into those places whence the sand is dispersed, till they come to that which has not yet been moved by the storm.

In some places, but particularly in the parish of Constantine, SECT. VII. in Cornwall, may be observed a *stratum* of gritty large-grained sand, Some in *strata*. spread under the vegetable soil, on the top of the *strata* of moor-stone; for that our moorstone lies in *strata*, notwithstanding any assertions to the contrary, will be sufficiently proved in the following pages. This sand is exactly of the same colour and substance as the moorstone below it; so that, till it is stirred from its natural position, to the eye it appears as moorstone. Some Naturalists have supposed this sand to have been fretted off from the moorstone, on which it lies, by the waters of the universal Deluge; but (supposing the waters of the Deluge of sufficient force to have effected such a separation, which is far from being agreed upon) upon examination, these sandy particles in a microscope seem too sharp and angular to have undergone such a trituration: besides, they are not placed specifically, as to weight and size, with large rounded pebbles intermixed, as they would have been if they had been separated from the surface of stones, and afterwards deposited by the waters of the Deluge: I should therefore rather imagine these sands to have been natural, and some of the primary concreted materials of which moorstone appears to have been formed, and that moorstone consists only of the same grit, cemented into stone by a crystal basis; that the basis, which forms all stone, was more abundant below in the bowels of the earth, than near the surface (as appears by the generality of fossils being of a more compact consistence the deeper we dig)^y; that, from a deficiency of this cement or basis near the surface, as well as the interfering powers of air, heat, and cold, this sandy grit never was fixed into stone, but always remained in the present incoherent state.

But the situation of sands most difficult to be accounted for, SECT. VIII. according to the theories at present most favourably thought of, is Sea-sand above Sea-

^x Thus the strand at Youghall, in the county of Cork, Ireland, is no more than a common turf-bog, covered with sand and pebbles. Hist. mark. of Cork, page 109.

^y See before, pag. 71.

that

that where sand lies either in a *stratum* on the highest hills, or in cliffs far above full-sea mark, with marine bodies, either mixed in and throughout, or deposited in a distinct separate layer. Of both these phænomena I shall describe two remarkable instances, and then endeavour to investigate the cause.

In St. Just. In a creek, called Por'nanvon, in the parish of St. Just, Penwith, near Cape Cornwall, in the Northern part of the cliff, (Plate XIX. Fig. IV.) inserted under the clay and rubble, are ranged horizontally many rows of large and small roundish pebbles of the granite kind (from B. E. to C.): the covering of this pebbly *stratum* is fifty feet deep from A to B on the North end, but only twenty from D to E on the South, consisting of a rough yellow clay, charged here and there with large and small stones, all with their angles on, but no solid *stratum* of rock above the pebbles. It is a very remarkable structure which this cliff presents us with, and highly deserves the attention of the curious in all its parts. First, the large pebbles, from one foot and a half diameter, to six inches, which are inserted now in the cliff, are of the same size and texture as those strewed on the strand below, which, being tossed to and fro by the force of the tide, owe their roundness most probably to their circumvolutions. Secondly, I must observe, that, upon examining the interstices of this pebbly *stratum*, I found many small black killas and flattish stones, all with their angles smoothed off, and between them sand of different kinds at different levels. That sand which was undermost, consisted of transparent granules, speckled with black, tasted salt, left a little colour of earth betwixt the fingers, but so little that it scarce coloured the water in which I washed it: the sand, higher up in this *stratum*, was less pure, approaching to the colour of reddish clay; but higher up, the sand was of a stronger yellow, equally salt, left some fine clay on the fingers, and in the microscope had many opaque and angular little yellow masses among its particles, as being more affected with the clay and gravel which lay over it, than what was deeper. In short, the sand of these interstices, though now fifteen feet higher at a medium than full-sea mark, had all the evidence which could be expected, that it had come from the sea, and was afterwards covered by a load of rubbish, from twenty to fifty feet deep.

In St. Agnes. Again: One of the highest hills adjoining to the sea shore, which we have in Cornwall, is St. Agnes Beacon, on the side of which mountain, computed at least 480 feet above the level of the sea, the *strata*, upon digging, appear in the following order: The vegetable soil and common rubble under it, five feet deep; a fine sort

sort of white and yellow clay, of the better sort of which tobacco pipes have formerly been made, six feet; under this, a layer of sand of the same nature as that of the sea below, six feet; beneath which is a layer of rounded smooth stones, such as the beach of the sea affords. Under this, four feet deep of a white stony rubble and earth, and then the firm rock, in which tin lodes shape their course. In both these instances the sea sand is lodged far above the level of the present sea. In Por'nanvon cliff it is at a medium 15 feet higher than full-sea mark: five and twenty Miles off, on the grounds of St. Agnes, near the Beacon, it is near 500 feet above the Sea. Other instances of the same unnatural situation of marine bodies, (which I here purposely omit) are to be found in other countries, as in Holland, Italy, and elsewhere, which have made all the chief Naturalists^z agree, that at one time or other, some of the highest mountains, as well as champaign lands, have been parts of the bottom of the sea, though now so much higher^a. And indeed let us re-consider and turn these circumstances into every possible light, and it must at last be confessed, that the bed of the sea has been undoubtedly moved upwards more in some than in other places, (of which I take these two before-mentioned instances to be irrefragable proofs) and it may be added, not only in Cornwall, but throughout the universe. But how, and when this happened, how these sands became promoted to their present station, is not easily decided. That fish of all sorts, should raise themselves to the tops of mountains with the waters of the deluge is not so wonderful; that they should be intangled, suffocated, and deserted there, as the waters retired, and precipitated by descending torrents into bodies^b of dissolved earths and stones, is also easy to conceive, but here the bottom of the sea has been raised, fixed, and become dry land. No earthquake could be the cause of this, for the convulsions of an earthquake would not leave the pebbles and sands so horizontally placed, as in Por'nanvon cliff, nor the clays, sands, and shingle, so orderly and specifically ranged, and the solid rock so firm and unshaken underneath, as in St. Agnes hills. The cause of this elevation was therefore equal to the force of earthquakes, but gentle and equable, acting under certain laws and restrictions, in order to accomplish some great event; an event requiring and worthy of such astonishing alterations. This great event could be no other than the universal deluge; I do not produce these phænomena, the translation of sands, as direct natural proofs of the deluge, (that rests sufficiently firm upon revelation, as well as the *exuviae* of marine animals every where dispersed on dry land,) but as plain intimations of the manner in which

^z See Varenius's Geog. lib. i. prop. 7. and Rohalt ii. Vol. p. 159. Steno's Prodromus, &c.

^a Ray's Physico-theological Discourses, pa. 130, 148, 214, 215, &c. third edition.

the sea now prostrate at the foot of cliffs and mountains, was raised and enabled to overflow the highest hills and afterwards gradually laid down to rest in it's usual bed. This is a part of natural history too extensive to be thoroughly discussed here, let it suffice to hint, what may one time or other, perhaps, be proved to the satisfaction of the curious; I advance it only as a conjecture at present, that it being determined to extirpate the human race, except one family, by overflowing the earth with water, the sea was the appointed instrument of destruction; that in order to raise the Sea to a sufficient height, the bottom, the bed, the chanels of the sea, were to be lifted up, and the wrinkles of the earth smoothed; that when the divine decree was accomplished, the same, first, almighty cause, which conducted the waters to their necessary height, withdrew that power which occasioned the elevation, and the chanels of the sea retreated again to their wonted level: ---- But this return was not uniform, exact, and universal in all parts of the world, but general, and sufficient to all the purposes of animal and vegetable life; consequently, far the greatest part of the up-lifted bottom, returned to the place from whence it came; part rested in it's most elevated station, hence the sands, pebbles, and shells, on the highest hills; part sunk somewhat, tho' some hundred yards short of it's former depression, as was the case at St. Agnes hill, and part sunk till it came within a few feet of the common level of the sea, whence the pebbles, sands, and shingle of Por'nanyon cliffs, and places which exhibit the like remarkable phænomena, are found so near full-sea mark.

This method of raising the sea waters, so as to deluge the earth, will appear at first sight, I imagine, too operose and unnatural to be chosen by an all-wise agent; it may be so; but let us enlarge our conceptions, let it be considered, that the highest mountians are no greater prominencies from the surface of our globe, than the dust upon a globe of one foot diameter; that the sea is no deeper than the furrows, nor the mountains higher above the earth, than the ridges in a sheet of paper. Supposing then these furrows to contain a sufficiency of water, and a determined resolution to make that water overwhelm the ridges of this paper for awhile; would it not presently occur, and seem the easiest and most eligible method to raise these furrows so as that the moisture contained might overflow such ridges, and afterwards, by letting them drop again, to restore both the ridges and furrows to their first intended situation? The diligent enquirer (besides the feasibility of this method, and the egregious absurdities of an *abyss*, *apertures*, *disruptions of the shell*, and the like, which are the insuperable difficulties of all other schemes for supplying water sufficient to deluge the whole earth) will recollect a great variety of phænomena in the present structure of the earth, which

which will serve to elucidate and establish this hypothesis. ----- So far for accounting for the different levels in which we find sea sand.

Since I have just now mentioned those inequalities in the surface SECT. IV. of the earth, called Mountains, and made little account of their height, it may not be amiss to say something of their origin, height, and the proportion that height bears to the diameter of the globe. This digression may be perhaps the more excusable, because some whimsical theorists have represented Mountains as of hideous height, deforming the earth, unfit to proceed from the hand of God, and only the wrecks and ruins of the antediluvian world. I shall not here detain the reader with the various opinions of the learned on this subject, persuading myself, that the most simple and brief account will best suit this work, and appear to the candid most agreeable to the ordinary operations of nature.

Mountains may be divided (as sands have been before) into natural and factitious, or into primæval, and those of a later date. The factitious are either the sudden effects of earthquakes, or the more gradual productions of vulcanoes, which throw up such quantities of stone, earth, and ashes, as raise first heaps, then hills, then mountains: These are not what I would treat of here: the question is, how such vast bodies as the Alps, the Appennines, the Andes, and other lofty mountains were generated, and came to exceed so much in height the adjacent lands.

Let it be granted, that the materials, or elements of which our globe consists, were, at first, in a mixed indistinct state; that the principles of solid and fluid bodies existed at the same time, but dispersed; that the stony particles were intermixed with earth, both disengaged by water, that the fire and air also were included in the general mass. This was the first state of our globe, the chaos of the more learned part of the heathen world, confirmed by the Mosaical Account of the creation^a, and agreeable to the appearances of natural bodies, where we find earth inclosed in stone, one sort of stone in another, the strata divided by fissures, some lighter strata underneath, and some heavier above; these were the little disorderly misplacings which could not but ensue from a mass including the unconnected parts of such a variety of bodies. When things were to be reduced into order, the solids were preadapted by the divine power to form the foundation, or the stiffnings (if I may so say) of the globe; stones fixed themselves, by their own gravitation in the lowest parts of the

The constit-
uent parts
of the globe
at first in a
mix'd state.

Divided and
indurated

^a Gen. i. where we find the earth gradually proceeding from a state of immaturity, to a state of

order, habitancy, and fertility, in the space of six days and nights.

earth,

earth, and their contractile powers pressed forth, and threw up into their proper elevations, the elements of air, water, and earth; elements, as necessary to the surface, as the stony strata were to the inferior parts of the globe. Such was the general division, but it is not to be imagined that in works of such immensity, a minute exactness could take place: No---there was more of stony matter

More hard and solid productions in one place than another.

in one place, more of earth in another; in some places stones became less porous, and contracted into a narrower space, in others more lax and diffused; some waters, some air, some fire detained at first in the interstices, and afterwards escaping, occasioned depressions, and extensive caverns; and the matter of fact confirms this theory, for the more we examine the structure of our globe, and weigh the phænomena, and consequences of earthquakes and vulcanoes, the more cavernous we find the earth, and of the more unequal density. In short, it was impossible in the nature of things, that such a multifarious body as our globe should settle and indurate with an absolute exactness, or that every part of its surface should be accurately equidistant from the center. It is easy to observe, that some countries abound more than others in rocks already formed, and others in waters lapidific, and ready to penetrate bodies immersed, and make their substance become stony^b.

Is it then any great wonder, that at the first induration, there should be more

of these stony principles, and consequently stony productions, in one part of the globe than in another; in other words, that the shell of the earth should be more or less dense in some particular places than in the rest? Now, wherever this greater quantity of stony principles was, and rocks settled upon rocks, and stood firm, there the higher grounds, craggs, hills, and mountains became protuberant, and above the common surface. If this stony process was in a ridge-like form, then it produced a chain of mountains; if conical, a sharp single mountain, or more in number according to the number of cones; where a quantity of air, fire, or water was inclosed at the time of induration, in proportion to the caverns which such extraneous elements occupied, so would be the subsiciencies betwixt the firmer and more stable eminences. If those caverns were deep and great, precipices would be formed in the sides of mountains, and in cliffs; if shallow and oblate, gentle declivities; if these declivities were greatly extended, then they shoot forwards, and make chanels in the sea; if damm'd up and circumscribed, they make lakes and seas; all these inequalities are the necessary result

Mountains and hills the necessary result of more solids in one part than in another, at the time of first general induration.

^b Stones and rocks are no more than earth cemented by lapideous particles, educed, suspended in, and collected by the common vehicle of water; these particles leave the fluid they are suspended in,

and concrete into stone when they meet with a proper nidus to rest in, and attract one another with greater force, than the water divides them.

of the solids settling and indurating in greater quantities in one place than in another; a disparity, not the effect of chance, nor the accidental concourse of matter and motion, but pre-ordained by God, as productive of more benefit to mankind, by the great usefulness of mountains and valleys, than if matter had been disposed in a more exact and equal manner.

What will add strength to this theory is, that we find the Karn or solid rock by no means level, or equi-distant from the center, but of a wavy surface, rising and falling as the hills and vallies, intimating plainly, that as some parts of the surface of the globe settled stone upon stone, and one rocky stratum upon another, and thereby maintained their elevation and prominency, other parts consisted of a thinner stratum, and there depressions were formed, the surface became lower, and nearer the center of the earth.

That this settling of the earth into unavoidable inequalities, and thus generating mountains, may appear more natural and comprehensible to every intelligent reader, let us consider in the next place the height of mountains.

All things are great or small by comparison, and as the mountains are but a part, and a very small part too of our globe, and we are now enquiring how such prominences as we call mountains should arise, the proper way of estimating their height, is by comparing them with the diameter and extent of our globe, whose surface they are thought to deform, and their height and size reckoned utterly unaccountable.

Supposing then (if we make use of round numbers, for which we will in the sequel make sufficient allowances) the diameter of the earth to be 8000 miles^c, the highest mountain will not exceed the common surface but one thousandth part, if it were allowed to be eight miles in perpendicular height from the sea; but the Andes of America, reckoned to be the highest in the world, are not judged to be near four miles perpendicular, consequently measured by the diameter of the earth, they are not a two thousandth part higher than the sea. In an artificial globe therefore of one foot diameter, the height of the mountains is too small to be measured by scale and compass, nay it escapes the sight; in a globe of eight feet diameter those unevenesses which to the eye that sees so small a part of the earth at a time are so stupendous, are demonstrably not so great as the twentieth part of the decimal of one foot; in other words in so large a globe, as that of eight feet diameter, the highest mountains are not prominent more than the thickness of half a crown English money. Again, consider the proportion which this height

^c Calculated to be no more than 7970.

bears to the circumference of the globe, and it will still be more diminished, in proportion as the surface of round bodies, is larger than the diameter. Consider then, (if we may compare small things to great) that if a potter were to make a globe of clay, and smooth it whilst it was moist, with all imaginable care, then set it aside to dry, is it possible that the soft should become hard, that the hard should become equally compact, and the texture exactly uniform, without such risings and fallings, such eminencies and depressions, as we may now see on the globe? Would there be no parts which would project $\frac{1}{2000}$ part farther than the rest? I conclude therefore, that the earth's indurating into a superficies, uneven in the same degree as our present globe, was the natural result of a mass of heterogeneous matter, unequally dispersed, passing from a state of liquidity, into a state of solidity and hardness. To return,

S E C T. VI. Sand is of various use, and according as it is differently constituted, I mean, fresh or salt, of a crystal or spar basis, smooth, or rough and angular, transparent or opaque, pure or mixed, it is chosen by artists for casting metals, making glas, cutting and polishing marble and free-stone, fixing of cement, and the like; but it is chiefly useful in Cornwall (according to the common opinion) in matters of husbandry, and therefore collected at a great expence from the nearest sea-coast, although indeed it is, generally speaking, not the sand, but the mixtures we find with the sand, which fertilize the land upon which they are carried. For sand being only a congeries of pebbles, or little grains of stone, can do little more than keep the ground loose and brittle, and this will go but a little way towards giving the husbandman a good crop; it is to the mixture of salt, slime, shells and coral, that we owe fertility.

Sea-sand. Sea-sand has greatly the advantage of river-sand in agriculture, and the salter the better, but all sand that is washed by the sea, is not equally proper for manure. In Mount's-bay, on the beach between Penzance and the Mount, we observe that when the North wind blows, and the water is smooth, we meet with a fine, light, opening sand, good for corn and grafs; for the sea then moving gently, and equably, whilst the North wind blows from the shore, drives the lightest sand foremost, into a truck, course, or chanel by itself, and gives leave to the more impure, and gravelly parts of those sands, to settle separately and farther back; but when the wind blows from the South, and the sea is turbulent, it confounds sand and gravel together, making a mixture utterly unfit for husbandry. In other situations the wind that blows off land must for the same reason, dispose the sea to leave behind it the best sand.

Blown

Blown sand, * which has been long exposed to the air, is good for little, its salts are so wasted by wind and rain, and its lime so evapourated; but take the like sized, coloured, and textured sand, washed by the sea every tide, or covered from the air, and the husbandman is well rewarded both in corn and grass. The slime mixed with sands, if earthy, and the product of putrified leaves, wood, and animal remains, will much enrich the soil, but if the offcasts of stamping mills, or the sediment of mines, their acrimonious mineral juices are mortal enemies to vegetation.----When sand is of a sparry calcarious substance, and will ferment with acids (as the sand of Heyl and of some other places will) then it acts as lime, and does of itself fertilize the ground in proportion to the lime which it contains. Better still is that sand which is plentifully mixed with shells and their fragments, for as shells are of the nature of lime, moulded and fixed into a shell by an unctuous cement, such sand, in proportion to the shells it contains, will give the heat of lime and the fatness of oil to the land it is laid upon. Of this sand they have some in the islands of Scilly, which good husbandmen find their account in preferring (though at a greater distance) to their other sands. In Cornwall, Whitsand-bay sand in Sennan parish has some fragments of shells, and sometimes entire small shells among it, it rises and plays up and down in *aqua fortis*, and makes a moderate effervescence like spar, but that which has the most shells, as far as I am yet informed, is that of Porcurnow Cove, near the Land's-End, which plays briskly, makes a considerable collu^ctation, dissolves in *aqua fortis*, and crackles much in the fire. All these sands have more shells at some times than other, according as the winds have been more or less favourable to the mixture.

But the best of all our Cornish sands, is that which is intimately mixed with coral : In places where this excellent manure is found, it is taken up by a large bag of the strongest canvas, to the mouth of which is fitted an iron hoop or frame for keeping it open, and sinking it to the bottom of the sea, so as it may receive the sand and coral as it is dredged along by the bargemen. A barge-load is usually deliverd for ten shillings, or less if nearer the place of dredging, and where the land is good a barge-load will dress an acre of ground ; it is used more for corn than pasture grounds. The fertilizing quality of coral is owing to the same cause as that of shells, for it is of the same limy nature, and makes a strong effervescence with acids, and, being more solid than shells, conveys a greater quantity of fermenting earth in equal space. Besides, it does not dissolve in the ground as soon as shells, but decaying more gradually continues longer to impart its warmth to the juices of the

* Sand blown up from the sea-shore upon the lands adjoining.

earth.

earth^a. The calcarious particles of which this coral is composed, are dispersed all over the western shores of Cornwall, as is plain from the coralline moss, incrustations, escharæ, sprig, and bunchy coral dispersed on the rocks, sands, and ore-weed of Mount's-bay, Land's End, and the North chanel, but the principal place in Cornwall where this coral is found in such quantity as to be dredged for manure is in Falmouth Harbour, and the shores adjoining^c.

Let me add that a great deal of this calcarious coral matter swims unfixed and liquid in the sea water, of which the testaceous animals form their shells, and into which the shells of dead animals are again resolved, and supply materials for the dwellings of a fresh generation. 'Tis to this coral impregnation that we owe in a great measure the fertility occasioned by the air, and froth of the sea, or sea-water carried upon the land with sand or oreweed. In small islands which are oftentimes washed all over by the spray of the sea during a storm, it is observable, that if some gentle rain immediately follows the storm, so as to wash in the nutritious contents of the sea-water, before they are dried and dispersed by the sun and wind, their grass and other plants thrive surprizingly.

C H A P. VIII.

Of Husbandry in Cornwall; its ancient and present State.

THE art of Husbandry was little practised in Cornwall two centuries ago^f; "Their grounds lay all in common, or only divided by stitch-meale, and their bread-corn very little; their labour-horses were shod only before^g, and the people devoting themselves entirely to tin, their neighbours of Devonshire and Somersetshire, hired their pastures at a rent, and stored them with the cattle they brought with them from their own homes, and made their profit of the Cornish, by cattle fed at their own door; the same persons also supplied them at their markets with many hundred quarters of corn, and horse-loads of bread." Car. p. 19, &c. This was a very disadvantageous state of the commerce of this county, for the products of the tin will always be fluctuating and precarious, but the necessity of flesh and corn is perpetual, and the returns from husbandry properly managed, annual, regular, and constant; people therefore increasing, and the mines sometimes

^a The several shapes in which this coral appears, I shall take farther notice of hereafter, among the marine productions.

^c Some coral is found on the coast of Ireland in Bantry-bay, and is counted the richest manure they have in those parts. Natural History of

Cork. Vol. II. page 380.

^f Not passed the remembrance of some yet living says Mr. Carew, page 66, who published in 1602.

^g Ibidem, page 67.

failing,

failing, the Cornish felt the necessity of applying themselves to husbandry, “ there being no trades, (says the judicious Mr. Carew, “ pag. 21.) which set so many hands at work, at all times of the “ year, as that one of tillage”. Their improvements answered their expectations, and in the latter end of the reign of queen Elizabeth, the Cornish found themselves in a capacity, not only to support themselves, but to export a great deal of corn to Spain, and other foreign parts. Cultivation has been advancing ever since, and better fenced, and more profitable inclosures for the plough are no where to be seen, than the banks of our greatest rivers Tamar, Alan, Fal and Fawy, and the sea-coast of our harbours can shew^h.

In the eastern parts of the county, they use lime made of a coarse marble-stone, for manure, and some of this lime rises in Cornwall: On the Barton of Wolvedon, in Probus parish, there has been lime-stone found; there is a lime quarry on the lands of Sir John Molesworth, Bart. of Pencarrow. Near Padstow, there is marble, but it has never answered the expence of burning for lime. At New-Kaye, in the parish of lower St. Columb, they find a coarse marble on the shores, which they have burnt for lime, and it burns freely, but the stone has so much of the crystalline matter in it, that in the lime there were found many small lumps of stone vitrefied, which greatly diminished the price. This is probably what Grew * (Mus. R. S. pag. 316) calls the worst sort of Cornish marble used for lime. The best lime-stone I have heard of raised in Cornwall, is in the parish of South Pedherwyn, which answers very well, and is much used thereabouts: This is near the confines of Devonshire, from which, (namely from Plymouth and Lyfton quarries) the Eastern parts have most of the lime which serves for manure.

Of marle the use is little known, and less practised in Cornwall; but marle we have in several places; so that we cannot so justly tax the land for being destitute of that useful manure, as blame the inhabitants, the greatest part of whom having sea-sand and ore-weed in plenty, do not heed what their own grounds might afford them to their great emolument; others again have their attention so much engrossed by tin and copper, that although they should turn up marle every day, and indeed often do so, yet every thing gives place to the greedy quest of metals. It must be allowed, that dressing abundantly with marle, as in some counties they are obliged to do, to the amount of fifteen or eighteen hundred loads in an acre, is extremely expensive, and cannot in a few years answer the expence, but our Cornish soil in general needs not so thick a coating, one hundred load may be enough in an acre; neither need we use any marle but what by experiment we find quickening

^h Having compared the waste, and the cultivated grounds of each hundred, as impartially as I could,

I reckon the latter are to the former as 20 to 11.

* Compleat Body of Husbandry.

and fertilizing, the first or second year at farthest: In place of that which will not turn to account till after some years distance, we had better substitute the present, easily acquired manures of sand, ore-weed, straw, and animal *fæces*, unless in such places where the lord of the land chuses to form a new foil; there a great depth of marle is necessary, and the inheritance will justify the measure. Marle both stony and clayey, may easily be distinguished from other fossils, by dissolving readily in water, and by the salt it contains crackling in the fire. Marle has been discovered and tried with success on the lands of Sir Richard Vyvyan, Bart. near Treloowarren. There is a yellow sandy marle, found in the same field with a newly discovered quarry of stone, in the lands of Mr. Scawen, about half a mile from the borough of Michel, which being laid on the grass there, much improved the vegetation; but the marle which answers best as far as I have yet heard, is that discovered by a farmer of St. Allen parish, near Truro; it is a stony grit, easily bruised between the fingers, ferments not with acids, soon permeated by water, but gives it no taste, is of a brown-ochre colour, and so full of yellow micaceous talc, that the farmer having thereby found much success in his crops, called it his gold-dust. Some marle of the same kind nearly, I have seen, found in the parish of Constantine; and some I have from the parish of Pheock, where it is laid by nature in great quantities, but neglected by the inhabitants. Some other sorts of marle, of a stiffer clay, and whiter colour, I have received from the Rev. Mr. Buckland, Vicar of St. Allen, which he has used to good effect, in improving coarse grounds. Of lime and marle therefore, we make not much use, but if other manures were to fail, it is not unlikely but more marle and lime-stone might soon be discovered.

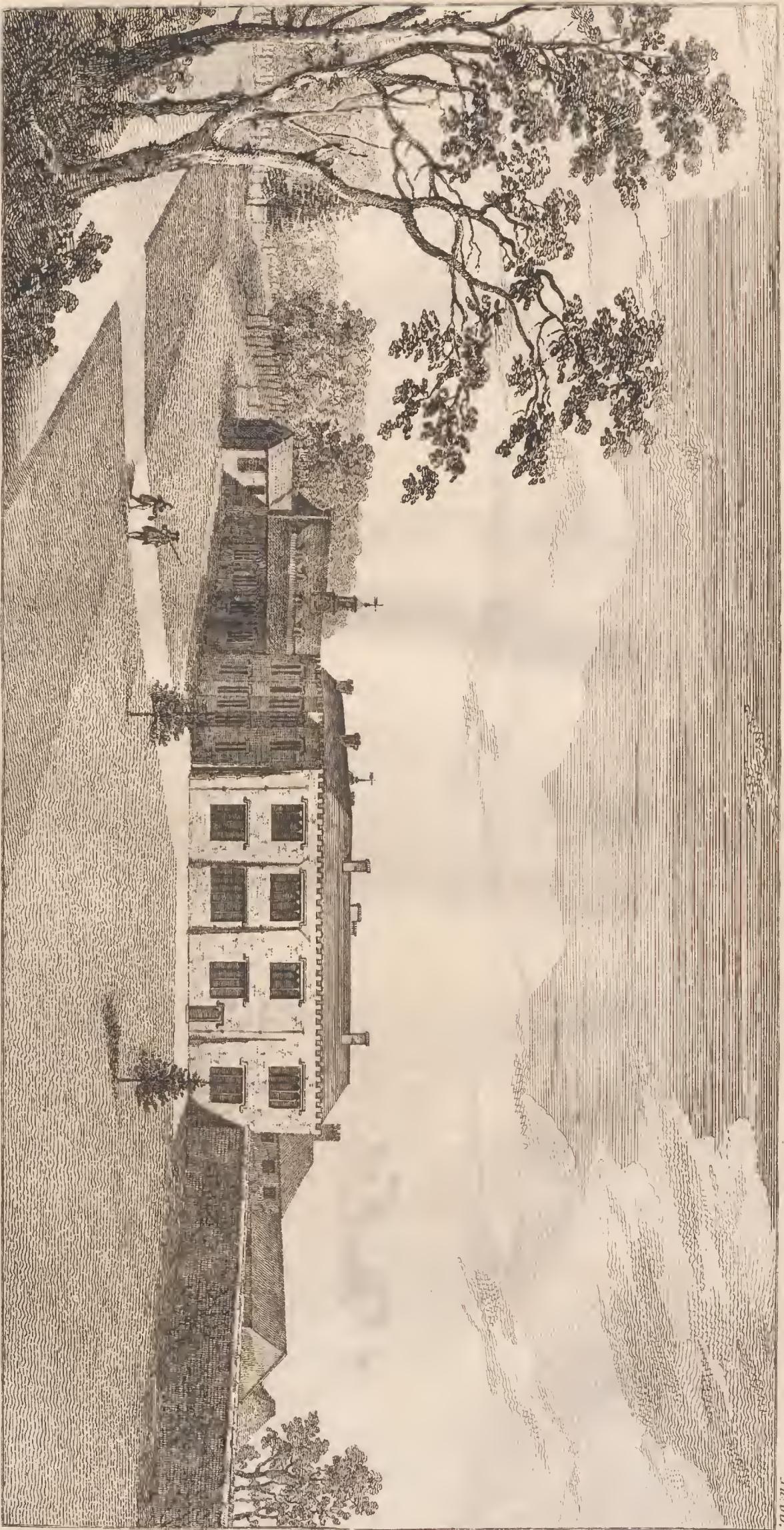
Sea manures. In Cornwall, our chief manures are from the sea, and the sea is very bountiful in this respect; not only sea-sand is used by every one who has it in his reach, but after storms we find the *Alga marina*, *Fucus*, *Confervæ*, or oreweed scattered in great plenty on the shore, and tho' the Italians neglected it¹, yet it deserves a place among the best manures which nature affords us. Some diligence and caution however, must be used, for being a submarine plant, the wind and sun will soon exhale all its moisture. The sooner therefore it is taken from the shore, the better, and being spread on old or stiff earth, then covered with sand, it soon dissolves into a salt oily slime, which contributes much to fatten and meliorate the other manures, and this is the most approved way of applying it. Some lay it naked, and

* — *Alga littus inutili*
Demissa tempus ab Euro
Sternet.

Hor. Od. lib. 3.

— — *Projectâ vilior Algâ.*
Virg. Eclog. 7.
+ See chap. preceding.

fresh



To J^r. Richard Syrwan Bar^t this south view of Trelovarren in the Parish of Manyan
Cornwall, engrav'd at his expence
is most gratefully inscrib'd by W^m Borlase.

fresh from the sea, upon their barley lands, in the end of March and beginning of April, and have a good crop of corn; but the weeds grow so plentifully and rank afterwards, that no wholesome grafts for pasture, is to be expected for that year. It is reckoned to give a disagreeable moisture to asparagus, potatoes, and other roots, and it is observed by Sir George Mackenzie,^{*} that lands often used to this manure, yield bad oats, and in a small quantity, the husks thicker than ordinary, and more darnel among the corn, than in lands which have not so much seaweed laid on them.

Other manures arising from putrefaction, burning the straw, and ^{Fish manure.} the *fæces* of animals are as common in this county as elsewhere, and differ not in their management; but near fishing towns, the husbandman in Cornwall has the advantage of purchasing, for a small matter, bruised, decayed pilchards, not fit for market, and also cast salt, that is, bay-salt which has been used already for salting pilchards, and being adjudged by the officer of the customs no longer fit for that use, is sold to the husbandman from four-pence to six-pence a Winchester: These offcasts of the pilchard cellars, consisting entirely of salt, oil, and putrefied fish, and easily carried, because little of it suffices, may therefore be reckoned the cheapest, as well as richest manure any where to be procured. It will warm the coldest land, throws forth plenty of natural wholesome grafts, as well as corn, and by the verdure it supports, demonstrates its lasting enlivening virtue even some years after it has been laid on. However, being extremely hot, experience soon convinces us, that it is best when left to dissolve, temper, and digest its salts in heaps of earth and sand, before it be carried forth upon the arable ground.

The seeds we sow are wheat, barley, oats, and rye, besides ^{seeds.} which, we have the *Avena nuda* of Ray, called in Cornwall pilez, which grows in the poorest croft-land that has been tilled two or three seasons before with potatoes, and for the uses of the poor answers all the purposes of oatmeal: It is a small yellow grain of the price of wheat (reckoned of the wheat kind) and for fattening calves, accounted superiour to any other nourishment. Rye is much less tilled of late years, since barren lands have been so improved as to bear barley; but of barley we make double use, and therefore have a double demand for it, I mean for bread, as well as beer. In Mullion, and some parishes near the Lizherd, they have sown barley, and in nine weeks commonly, oftentimes sooner, they have had it again in the sack, fit for market. This quick return is not owing to any one particular sort of barley,¹ but to the soil and situation, and a kindly warm season, the nights in the summer

^{*} Philos. Transf. No. 117, pag. 390.

¹ As Dr. Plot seems to think, Oxfordsh. pag. 55.

time

time on the sea-coasts being seldom or ever cold^m. The greatest crop of this grain which has reached my notice, is that of a field near Philac church, in which, as the Rev. Mr. Glover, Rector of that parish, assured me, he had, in the year 1752, thirty bushels of barley, each bushel containing three winchesters, on one statute-acre of land.

As to wheat, some of our lands are also very fruitful, the most remarkable instance I know, is that of Thomas Roberts, Tanner, of the town of Penzance, who, in the year 1740, had twenty bushels of wheat, (each bushel three winchesters, or twenty-four gallons) on one statutable acre of ground, adjoining to the town; and he had not only plenty, but was equally fortunate in the price, for he sold each bushel for one guinea, so that deducting one guinea, which he paid for the tythe, he made nineteen pounds nineteen shillings clear, of the grain produced by one acre of ground. In Cornwall it is the custom to bind into sheaves the barley and all other grain, as well as the wheat, and for their better security afterwards, we make all our corn into arrish-mows, the sheaves being built up into a regular, solid cone, about twelve feet high, the beards all turned inwards, and the butt end of the sheaf only exposed to the weather; the whole cone is finished by an inverted sheaf of reed, or corn, and tied to the upper rows: This custom may be partly owing to the greater inconstancy and moisture of our weather in Cornwall than elsewhere, and to the use of coarser grains in bread, (which therefore require the more security) but whatever the cause is, the consequence justifies the precaution, and the grain is thereby much better preserved: By this means indeed our fields, in time of harvest, make a very singular appearance in the eyes of strangers, as may be seen at F. f. in the prospect of Enys, the seat of John Enys, Esq; PL. VII. which was drawn in the time of harvest; but in inclement harvests our corn must be guarded from rain and wind better than by the manner of sowing the grain in the neighbouring countiesⁿ. Our market-measure of those seeds is irregular, our common bushel is reckoned to consist of three winchesters, or twenty four-gallons. In the larger farms we generally plough with two or more oxen, and two horses before them, which make but a slow progress, especially as our ploughs are dragged through the ground. It is the general custom, at the last tillage of the ground, to sow twelve gallons of Ever-grass^o, with ten pounds of clover^p, or

^m For the same reason, namely, the uninterrupted progres of vegetation by night as well as day, corn, in Lapland, ripens sooner than in France. Linnaeus Transl. of the Acad. Sued. vol. i. pag. 22. Pontopid. pag. 101.

ⁿ I am informed they have the same eustom in some of the inland parts of Germany, where the

apprehension of rains need not be so great as in Cornwall.

^o Gramen Loliaceum; five *Lolium Rubrum*. Ray. 2d. Edit. pag. 249.

^p *Trifolium purpureum majus*; or *sativum* of Plot, Oxford. pag. 156.



To John Crys Esq; This View of Enys house
in the parish of Gluvias, Cornwall, engraved at
his expense is most
gratefully inscribed by
Wm. Borlase.

the melilot trefoil⁴ in each acre. These trefoils thicken the ever-grass, and both together considerably add to the pasture, especially in poor lands and narrow limits, in the former of which the husbandman cannot expect natural-grass under two or three years, and in the latter he cannot stay a year for the natural-grass to come without distressing his cattle. Saintfoin, or everlasting-grass has of late been introduced, and in dry, coarse, shallow grounds, it is thought may promote pasture. Of late, the turnip husbandry has begun to obtain, and several gentlemen have experienced the benefit of this useful root, in feeding sheep and other cattle, and mellowing the land for corn. The potatoe is still a more useful root, now every where cultivated, and in shallow, poor lands, seasonably tilled thrives best; grateful to the rich, the support of the poor, and most salutary to both. There are two sorts; the flat, or kidney potatoe, which may be planted early in the winter, and will be fit to draw about the midsummer following, and lasts in perfection till Christmas. The other which is a round potatoe, and ought to be planted in the spring months of April or May, will be fit to draw at Christmas, and will last in perfection till the Autumn after. Of this latter sort (which grow very large in an airy, sunny spot) I had one brought me in January 1756, which was thirteen inches and $\frac{8}{10}$ in girt, and seven inches long, and weighed when taken out of the ground, thirty-two ounces; after it had been drawn some days, I found it to weigh twenty-nine ounces and a half; I placed it in a sunny corner, and found that it produced potatoes, great and small, to the number of twenty-one.

Mr. Camden tells us, that “ all manner of grain, in his time, “ was produced in such plenty in Cornwall, that it did not only “ supply the necessary uses of the inhabitants, but Spain also, “ with vast quantities of corn;” but we must now make a different estimate. The inhabitants since Camden’s time are more advanced in number than the tillage has increased in proportion, and though the low lands in Cornwall, especially along the Tamar and Alan may yield more corn than the inhabitants of those parts, and the less fruitful hundreds of Stratton and Lynewyth can dispense with, yet the hundreds of Poudre, Kerrier, and Penwith, and the western parts of Pydre (far the most populous tracts of our county) do not yield corn near sufficient to supply the inhabitants. Upon the whole, if those parts entirely addicted to husbandry, will yield a sufficiency of grain to make up, in a moderate year, what is wanting in the parts less cultivated, and more addicted to mining, this is full as

⁴ *Trifolium agrarium Dodonæi.*

⁵ Engl. pag. vi.

much as can be asserted in this particular. In a plentiful year we may spare a little quantity for exportation, in a moderate year have enough for ourselves, in a year of scarcity not near a competency. As the ballance is so even, it is the interest of the Cornish by no means to slacken or reduce the present state of husbandry, by withdrawing too great a number of hands from it, for working their mines. Husbandry, it must be remembred, can employ and subsist a people without mining, but mining can do neither without husbandry. If mining, tempting as it is with the hopes of sudden and immense gain, exceeds much its present limits, agriculture must decay; it is best therefore to encourage both, so as that the former may promote the plenty of money, the latter of food and rayment, and both the happiness of that spot where they meet and reciprocally relieve, as they do at present the deficiencies of each other. It is a facetious, but no uninstructive story which Plutarch (*de Virtute Mulierum*) gives us on this occasion¹. " Pythis a king, having discovered rich mines in his kingdom, employed all his people in digging them, whence tilling was wholly neglected, insomuch that a great famine ensued. His queen, sensible of the calamities of the country, invited the king her husband to dinner, as he came home hungry from overseeing his workmen in the mines: She so contrived it that the bread and meat were most artificially made of gold, and the king was much delighted with the concert, till at last he called for real meat to satisfy his hunger. Nay, said the queen, if you employ all your subjects in your mines, you must expect to feed upon gold, for nothing else can your kingdom afford you."

C H A P. IX.

Of the Stones in Cornwall.

IN Cornwall, where there are not only Quarries of stone as in other parts for building, but a great number of mines, a variety of stones must needs offer itself to our examination. They may be all ranged under the following general heads. First, stones of use. Secondly, stones of ornament and curiosity. And thirdly, stones of profit².

SECT. I.
Quartz.

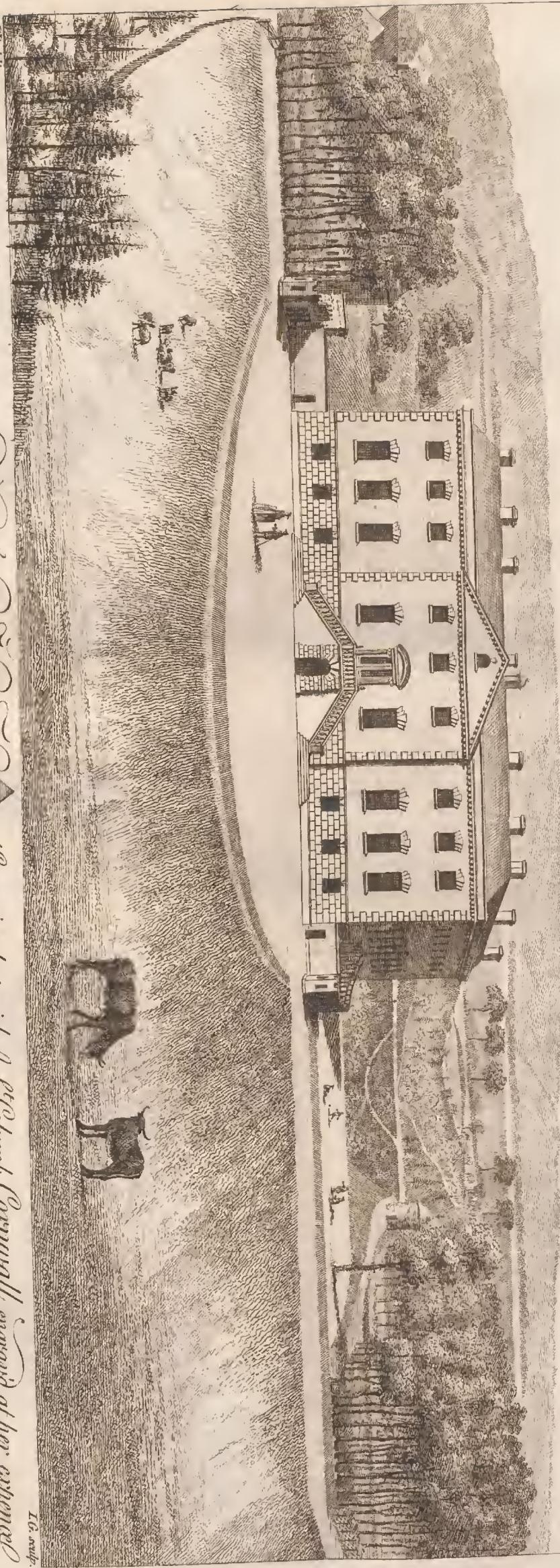
Stones of use are either of inferiour, or important and necessary use. Among these of seemingly small importance, I must reckon what

¹ Thus englisht in Fuller's *Holy State*. p. 107.

² We shall observe as we go along the *clases*, *orders*, *genusse*, and *species* of the chief stones, as

ranged by the systematical writers, though we cannot entirely pursue their method, in a particular natural history of a county.

the



No. 100.
To Mr. Jane Stoblyn this South view of VANSWINDEN House, in the parish of St. Columb, Cornwall, engraved at her expense
by Wm. Borlase.

the surface of the land in most parts of Cornwall, yields in great plenty, I mean an opaque whitish debased crystal, commonly (but indeed erroneously) called white spar; these stones are extremely hard, and repair roads, and face our hedges; being full of angles they make the best pitch-work for paving courts, stables, and the like; the pavement not easily growing slippery, or breaking, where these stones are well laid^u. This stone by the Germans is called Quartz, and because we want a name for it in English, it will be so called for the future. It is vitrescent, strikes fire with steel, not soluble with *aqua fortis*^v, and is the general *basis* of most of our Cornish stones.

In most of our compound stones in Cornwall, there is more or less of a black stony matter which we call Cockle. Sometimes it is intermixed as spots and veins, and sometimes it is the *basis*. Broken transversely it is of a dull earthy black, scarce so bright as the dust of pitcoal; its texture consists of fibres parallel, and glossy, these fibres make either *laminæ*, *striæ*, or granules^x. It shews itself every where fibrous, and when it is in its purest state, and has neither metal, nor stone different from itself (as we often find it in the parish of St. Just) it shoots into granules of irregular planes, inclinable to a prismatic figure, not in the least flexible, but shining and resembling in shape, the granulated crystals of tin-ore, and when free of earthy impurities, ponderous and so near to the specific weight of that metal, that nothing but tryal by water or fire can distinguish the cockle from tin. It is nothing worth of itself, but 'tis either the *basis*, or makes a considerable part of our most useful, and remarkable stones. It weighs to water as $3\frac{8}{99}$ is to 1^y.

Another common stone with us in Cornwall is the Elvan^z, of Sect III., very close grit; and so extremely hard that it will not cleave, nor break to face or joint, and if tin-ore happens to be included in this stone (of which there are several instances in Senan parish and elsewhere) 'tis not worth the pains of getting at, unless it be in greater quantities than what we generally find in such hard stones; if used in building it generally goes into the wall in the same shape that

^u Two parcels in casks have been lately sent from Truro to London at the desire of some persons principally concerned in the porcelain manufacture, for which their colour and hardness seem to render them a necessary ingredient, as well as for making of glaſs, and fusing of copper. Linnæus, System. Nat. page 153.

^v Of the second genus of Linnæus, Syſt. Nat. page 153, it is the second species.

^x Of both the former I have ſome instances from Castle Tretryn in St. Levin.

^y Dr. Woodward, Cat. Vol. ii. page 23, calls

it "a black thready mineral, ſeeming to be a fibrous talc." Hill, page 499, calls it "a foliaceous, black, crystalline talc." Linnæus ſeems to have the ſame body in his view among his *micae*, in the fourth species of his apyrites, *genus 7*, page 159. See alſo his ſecond species of talc, pag. ſequ.

^z Quasi ab Hēl-vaen, i. e. the ſtone generally found in brooks; unleſs it be a corruption of Anvon, which in Cornish ſignifies a ſmith's anvil, and might fitly represent this very hard ſtone.

nature left it in ; it is not found in strata or quarries but in detached angular masses, sometimes in large rocks, and is usually of a grey blueish colour. If the nodules of this stone are found of a portable size and a plane surface, so as to need little polishing, they make stones for grinding the most precious colours, far beyond any marble and equal to any porphyry.

There is another sort of Elvan, which consists of a yellow clay cement, thick set with opaque, white and yellow crystalline granules, and these thinly besprinkled with cinereous grains ; both the grains and granules have smooth and plane surfaces : This stone rises in a quarry at Boreppa in Camborn, and elsewhere, is found in large nodules, immersed five feet deep and more in the Vorlas clay-pits in Ludgvan, and in smoothed nodules on the beach betwixt Penzance and Marazion ; it is not near so hard as the former.

S E C T . IV. More common still, of more various appearance and necessary use, is the stone which we call Killas^a. It is of the schistos kind, some sorts more friable, and some more laminated than the rest ; there is scarce any field or common, where in some shape or other we do not find these stones, but where there are any quarries of it, the top of the stratum is covered with loose, thin stones, interspersed with earth and clay, and a few feet below, lies the solid stone, the crevices of which are nearly perpendicular and horizontal ; these stones generally dip towards the West, and rise flat, of a very even thickness, for which reason I imagine they are called by the Tanners, Raze^b ; they have a smooth face for building, and make a strong wall, but are apt to be feather-edged, which makes them lodge water, and throw damps into the walls. There are three sorts of this stone, the yellow, the cinereous or blueish, and the brown. The yellow is hard and lasting, if laid in nearly the same figure as it rises, but breaks easily into shivers, and across the grain, so that it will not bear hammering ; it does not ferment with *aqua fortis*, nor give fire with steel, of a sandy grit and uniform texture, with a yellow ochreous clay in its commissures, and weighs to water as $2\frac{9}{124}$ is to one.

The blueish killas is sometimes so exceeding hard and stubborn, that in the mine they give five pounds a fathom^c for breaking it ; at other times it is as easy to break as pitcoal. Round the town of Marazion, and other places, (but better still in a large and ancient quarry at Helston in Kerrier,) there rises a very tender killas, of the cinereous, and also of the yellow colour, both sprigged with specks of a darker hue, the texture of both the same,

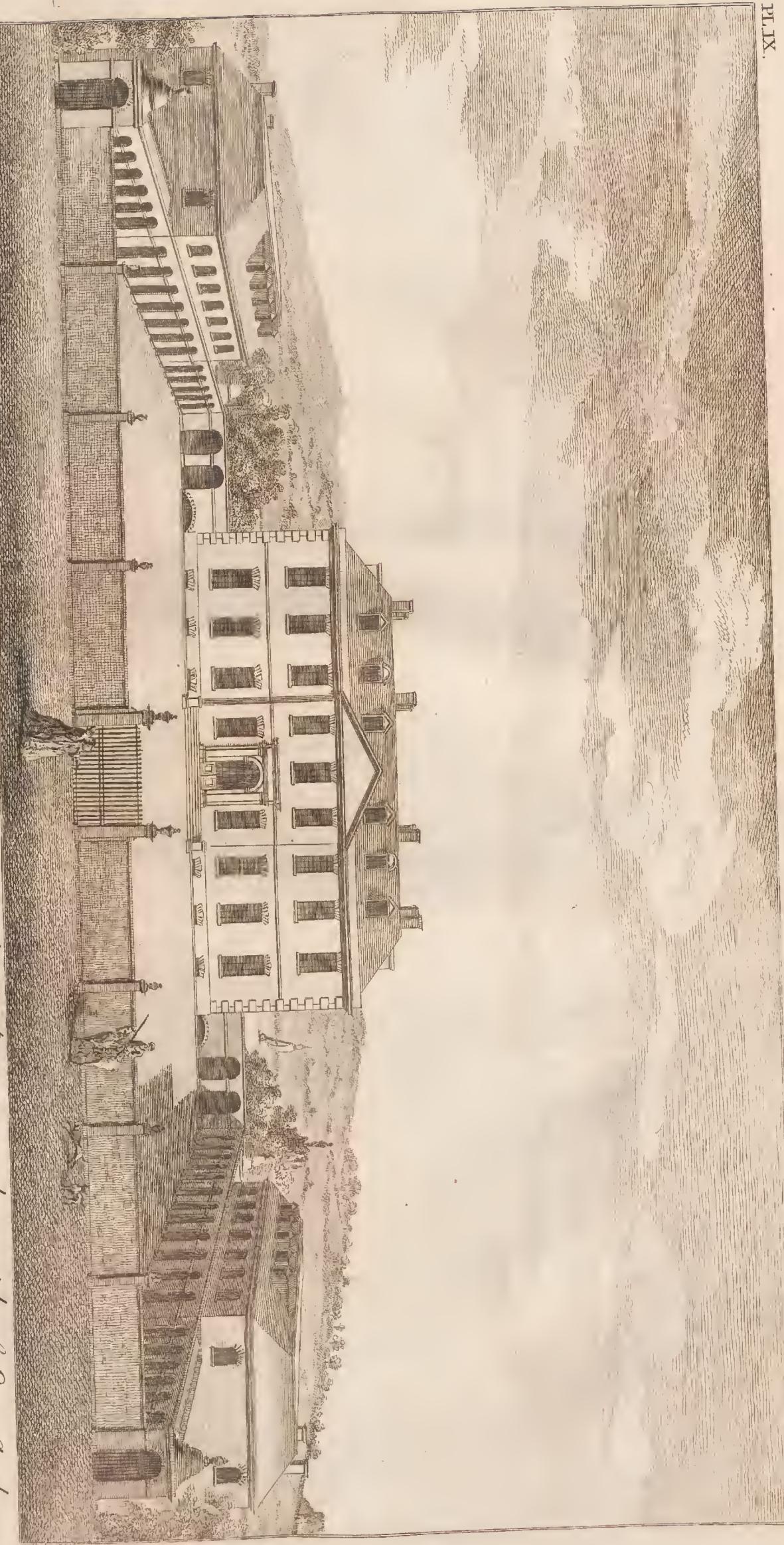
^a Dr. Woodward Cat. V. ii. pag. 6. says we call any stone killas that splits with a grain.

^b Woodward's Cat. vol. i. pag. 202. m. 9.

^c Six feet long, six high, and three wide.

viz.

To Francis Buller Esq this view of
Cornwall, engrav'd at his expence, is
most gratefully inscrib'd by
Wm. Borlase.



viz. a very small proportion of stony cement added to a fine sand and earth. This stone is consequently of a small grit, is very easy to square, and makes very dry walls and close joints, but seldom rises larger than from a foot high to two feet long, and is apt to scale off at the corners. Of this kind, but of a more compact, uniform, and finer grit, we find in some places very good whetstones for edging knives and other tools: the rock, called Karn-Jenny, near Penzance pier, produces a course of these almost as fair and good as the hones of the shop, and are used as such in that neighbourhood. A specimen of this kind weighs to water as $2\frac{88}{97}$ to 1.

Some of the cinereous killas consist of thin *laminæ* laid in straight lines one over another in like manner as flat, to which it approaches very near, but never rises wide and thin enough to answer the uses of it. Its masses however are larger than those of the Helston quarry, but more spungy, subject to soft places, and more apt to decay and give way to the weather. Of this stone is built the house at Nanswhydn, Plate VIII.

In many places the quarry-stone of the brown ferruginous killas rises large and hard, and with this they build in the Western parts of Cornwall, and in the East at Camelford, Lanceston, and elsewhere; but it is subject to the same inconveniency of damps as the yellow before-mentioned. In some places it rises in such large flakes, so easy for working, and they may be laid on their edge so close, that they prove excellent materials for building piers and moles into the sea; the best I have yet heard of, is that which rises on the parsonage grounds of Mawnan, from which a great deal is carried off yearly for building and repairing the Kayes at Falmouth, St. Maws, and other trading towns in that harbour.

On the South coast, betwixt Liskeard and the Tamar, there are SECT. V.
Slat. some quarries of flat, which is brought down and shipped off at Tidiford and Morham, and, by means of the Tamar, supplies the neighbourhood of Plymouth with covering for their houses, and is thence exported in pretty large quantities: there are also some quarries of flat at Padstow on the North coast, whence, for many miles to the East, the whole country is subject to a shelfy flat. There is a better quarry still at Tindagel; but the best covering flat which we have in Cornwall, and indeed in all England, “ perhaps the finest in the world,” is at Denyball, about two miles South of Dennyball
quarry. Tindagel, which will therefore require our more particular notice. The whole quarry is about 300 yards long and 100 wide: the

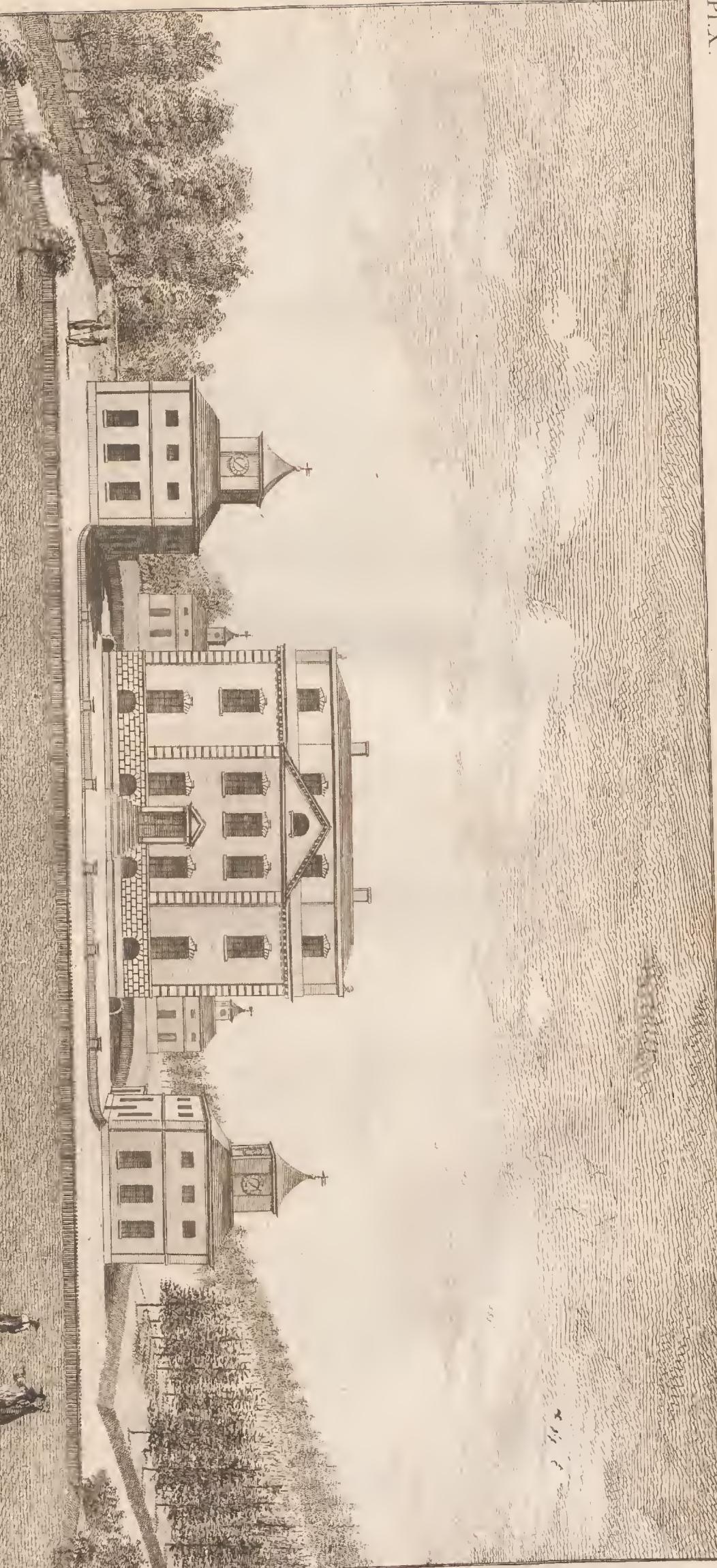
* Dr. Woodward, Cat. vol. II. page 5.

deepest part from the grass, is judged to be forty fathoms: the *strata* in the following order: the green sod, one foot; a yellow-brown clay, two feet; then the rock, dipping inwards into the hill towards the South-West, and preserving that inclination from top to bottom: at first the rock is in a lax shattery state, with short and frequent fissures, the *laminæ* of unequal thickness, and not horizontal: thus the rock continues to the depth of ten or twelve fathom, all which is good for nothing, and entirely to be rid off; then comes in a firmer brown stone, which becomes still browner in the air: this is fit for flatting houses, and the largest size for flat pavement, never sweating as the cliff flat which is exposed to the sea-air. This is called the *top-stone*, and continues for ten fathom deep, the stone improving somewhat as you sink, but not at the best till you come to twenty-four fathom deep from the grass; then rises what they call the *bottom-stone*, of a grey blue colour, and such a close texture, that on the touch it will sound clear, like a piece of metal; the masses are first raised rough from the rock by wedges driven by sledges of iron, and contain from five to ten, twelve, or fourteen feet, superficial square of stone: as soon as this mass is freed by one man, another stone-cutter, with a strong wide chisel and mallet, is ready to cleave it to its proper thinness, which is usually about the eighth of an inch; the shivers irregular from two feet long, and one foot wide, downwards, to one foot square, and sometimes (though seldom) dividing into such large flakes as to make tables and tomb-stones.

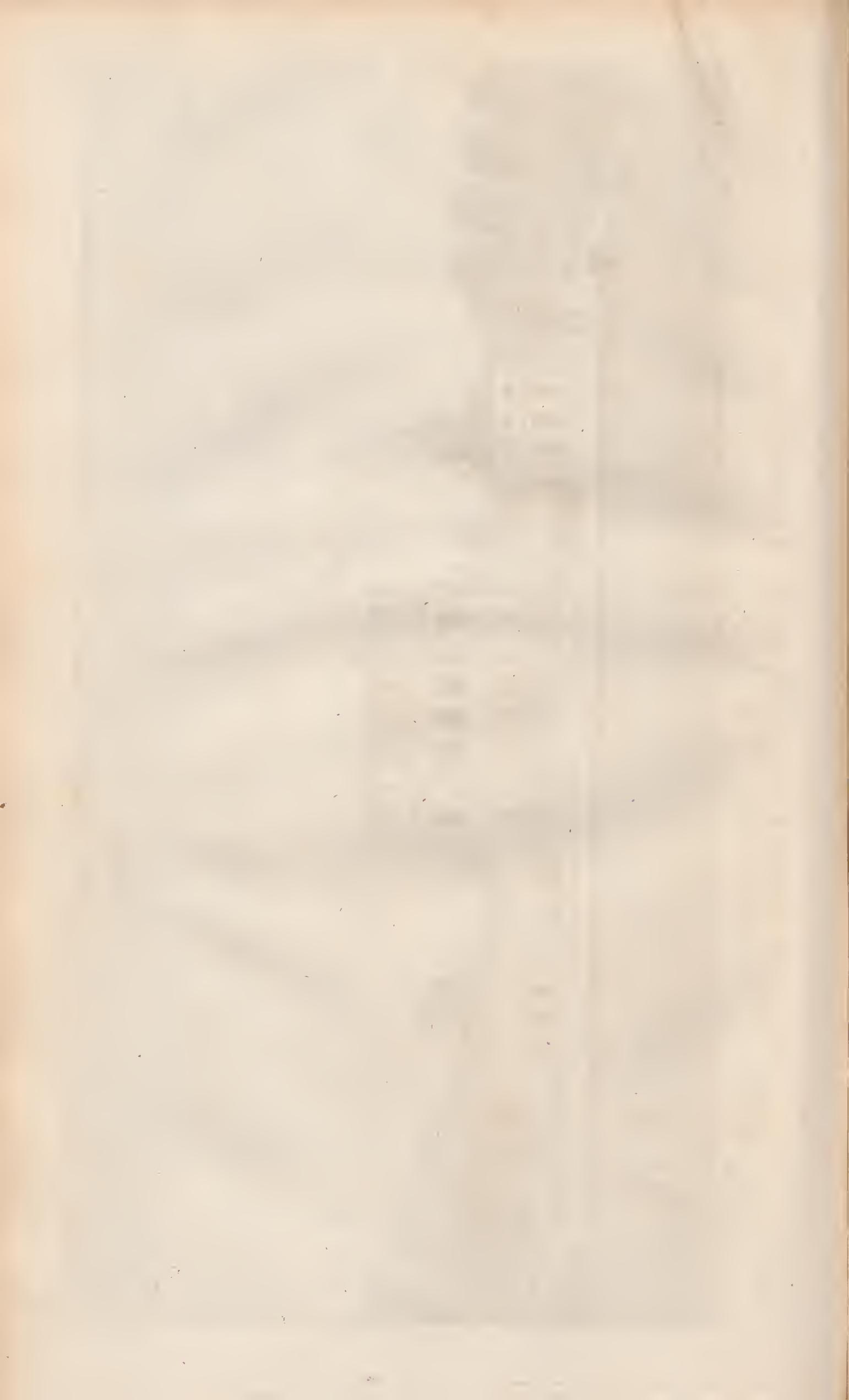
In this quarry several parties of men work on separate stages or floors, some twelve fathom from the grass, some twenty, others forty fathom deep, according to the portion of ground belonging to each party; the small shattery stone, not fit for covering houses, serves to shore up the rubbish, to divide the different allotments, and shape the narrow paths up and down the quarry; all the flat is carried with no small danger from the plot where it rises, on men's backs, which are guarded from the weight by a kind of leather-apron, or rather cushion; the carrier disposes his charge of stones in rows side by side, till the area allotted to his partners is full, and then horses are ready to take them off, and carry them by tale to the person that buys them. The principal horizontal fissures, which divide the *strata*, run from ten to fifteen feet asunder; they are no more than chinks or joints, and contain no heterogeneous fossil. The stone of this quarry weighs to water as $2\frac{62}{121}$ are to 1, is not subject to rot or decay, to imbibe water, or split with falling, as the *bottom-stone* of Tindagel, and other quarries; but for its lightness, and enduring weather, is generally preferred to any flat in Great-Britain.

If

* *Schistus fissilis*, durus, *cœrulescens clangosus*. Linn. Syst. Nat. page 158, N°. I.



To Francis Basket Esq; this Eastern view
of Trehedy in the parish of Illogan, Cornwall,
engrav'd at his expense
is most gratefully inscrib'd by
Wm Borlase.



If this quarry was situated nearer to a good harbour, much greater advantage might be made of it ; but all the stone exported, must be carried by land to a little cove, called Portissik, four miles off, on the North coast, where no ships of burthen can safely take in their loading ; and what is not exported, is dispersed in the neighbourhood by an expensive land-carriage. In some places^f we have a very red flat in small shivers, the only use of which, as far as I have learnt, is, that it serves the mason and carpenter to line and mark out their work.

In the next place let us take a view of those stones which consist of a larger grit, and a more compounded nature, than what are gone before. And, first, of the free-stone, or *lapis arenaceus* : This is of two sorts; the free-stone consisting of sand and spar, and that which consists of a sand and quartz. The purest free-stone (I mean, that nearest to the natures of Portland, Oxford, and Bath-stone) that I have seen raised in Cornwall, and indeed the only one that may be strictly so called, as far as I yet know, is found in the parishes of Carantoc and Lower St. Columb, in the latter of which parishes it makes a *stratum*, about twelve feet thick, at New-Kaye, where this stone may be had in great quantities, and of almost any dimensions, nearly level with the surface of the ground, and contiguous to the sea. Its grit is of a small yellowish sand, cemented together by spar. That which has been exposed to the air for any time is very hard, as we may see in the old church and tower of Carantoc, which are built in great part of this stone : it wholly dissolves in *aqua fortis* ; it weighs to water as $2\frac{1}{2}$ to 1. It imbibes water plentifully, and retains it too ; and consequently would imbibe the moist cement, and make a compact close wall, dry as brick. If a quarry of this stone were properly opened, no gentleman in Cornwall needed to send to Portland ; for, without question, this stone, though not altogether so fine, would serve all the purposes of that ; and it is somewhat surprising, that such a treasure as this stone might prove with management, should lie bare to the eye, and so convenient for water-carriage, and yet hitherto neglected. This is the only perfect free-stone which I have seen in Cornwall ; but in several places on the North coast, we find a stone of the same structure and materials, though incomplete, and in a state of immaturity, as I imagine, having never arrived to a hardness sufficient for use. These imperfect stones which are spread here and there among the Gwythian and Piran sands, are the accidental formations of a thinly dispersed sparry or *corallin* juice, blown up, together with the spray of the sea, in

SECT. VI.

Cornish free-stone.

^f In the parish of Constantine, and elsewhere.

quantity sufficient to connect the sand together, but not enough to concrete into a firm hard body. Dr. Woodward's Cat. vol. II. p. 3, says the inhabitants call it a kerned stone; that is, a coagulated stone, but just congealed; and indeed it is no more than the blown sand incrusted into stone in so many thin separate layers, one over another, as the sand was thrown in, mixed with the sparry spray, at several successive times, by the Northerly winds. Let no one wonder that the spray of the sea shall produce such an effect; for that spar is suspended in all water is likely; but, in particular waters, is evident from incrustations formed in the bottom of culinary vessels, and in water-pipes, from petrified moss, and many other phœnomena; and that spar is also to be found in sea-water, must certainly follow, from the sea being open to, and ready to receive, all that springs will convey into it. All coralloid bodies and shells are formed of spar, modified and mixed so as to comply with the occasions of marine plants and animals^a. Lastly, spar is washed out of the cliffs and rocks exposed to the power of the sea; nay, great degrees of heat will raise it in vapour, and what rises so into the atmosphere, is doubtless again condensed and precipitated by wind, cold, and rain^b. In several parts of Cornwall we have a *lapis arenaceus* or free-stone, consisting of sand and quartz. Near the borough of Michell there is a pretty stone, not long since discovered, of a cinereous ground, speckled with white gravel: it works very smooth, and keeps a neat edge. In Gwenap there is a whiter stone, and in Stithien one of the same kind.

Polrudon stone (commonly called Pentowan) is likewise of the arenaceous kind. This stone lies in a lode about fifteen feet wide, not intersected by horizontal and perpendicular fissures, as in *strata* of free-stone, but shelving, and in irregular masses, and of three different colours; the first and finest of a milk-white ground, thinly besprinkled with purple specks about the twenty-fourth part of an inch in diameter; the second of a cinereous ground, with more, larger, but fainter purple specks; the third of a yellow ochreous ground, speckled, but the purple less distinct, with some micaceous talc thinly interspersed. Dr. Woodward's Cat. vol. II. page 4, had two specimens (b 2, b 3, ib.) from this quarry; one of an iron-colour, and indeed an irony-water, I observed here to discolour somewhat of the superficies of the stones; but in the heart, I found them always of one of the three before-mentioned colours. Dr. Woodward, ibid. calls this a free-stone, and not improperly, if he meant only a *lapis arenaceus*; but it is greatly different, both as to

^a See page before, 84.

^b See Woodward's Cat. vol. I. pa. 116—113,
etc. "About Cappelsham the corals dispersed

about the shores uniting with the sand, make a solid stone." Linnæus Amæn. Academ. page 463.



No. 100.
To William Lemon Esq. this South View of CARCLEW
House in the parish of Mitor Cornwall, engraved at his expense
in most gratefully
impartiality
by Wm. Borlase.

ground and charge, from the Portland, Oxford, and Bath-stone; for all these are called free, not only for their ease in cutting, but for giving way to acids; whereas our Polrudon stone will cut indeed, but not near so freely as the forcementioned, and will not at all ferment with *aqua fortis*: our Cornish stone is cemented by a crystal or quartz basis, and therefore is radically distinct from those stones of Portland, Oxford, and Bath, which are concreted by a spar. Of Polrudon stone is built the house of Anthony in this county, Plate IX. page 92.

Of a finer closer grit still is the free-stone raised on Illogan downs, of which the eastern front of Tehidy house, Plate X. p. 94, is mostly built. The ornaments of the portal and windows and cornice are of Portland, but the main body of the Cornish stone, which is so near the texture and colour of the Portland, that it requires a very near inspection to distinguish one from the other. It unfortunately rises in such small masses, that it will seldom square to one foot and a half in block; and in this quarry there is so little found of it, that there was scarce enough to finish the front below the cornice¹.

From the arenaceous let us proceed to stones of a larger grit. SECT. VII.
In Cornwall the moor-stone appears in greater plenty than any Moorstone,
other: It is scattered over our hills from the Land's End through the
Hundreds of Penwith and Kerrier. In Pydre Hundred there is
some; but the flat and killas begin there to prevail and reach from
Padstow, along the North sea, to the extremity of the county. In
all the higher parts of the southern hundreds the moorstone keeps its
ground; and in general we may say, that the highest tors in the
county are usually spread with what we call moorstone, from its
being found most commonly in uncultivated moory hills and vallies,
for in both situations there is great plenty of it, but oftener
indeed to be seen on hills, the same rain and floods laying stones
bare on the tops and sides of mountains, which cover them as often
in the vallies. It is a great mistake in Naturalists, to imagine, that
moorstone does not lie in *strata*². The stone-cutters indeed do not
open any quarries for moorstone¹; because that would be a needless
labour, not because they cannot find moorstone under the ground;
every cliff, crag, and precipice, and a great number of mines, may
convince us, that this stone lies in floors and layers, *stratum* upon
stratum, intersected by horizontal and perpendicular fissures; for

¹ There is a very white stone of this kind, of a fine, small, and uniform grit, which I have observed about the midway between the borough of Camelford and the church of St. Teath, which may very well reward a further search.

² Hill's Fossils, page 499. Woodward, &c.

¹ So many large detached rocks of this kind of stone appearing above ground, and the masons seldom working on any in the bowels of the earth, may have occasioned hasty memorandums, made *en passant*, which thence crept into collections and catalogues, and thence from one book to another.

evidence of which, we need go no farther than the rocky beach, and precipices at St. Michael's Mount. Moorstone, where there is no defect, does not cleave to faces, as flat and killas, but breaks irregularly, as marble; yet can the masons cleave tall columnar masses eight or ten feet long, and sometimes longer, out of a block of stone: they do not depend on a hole full of water to soak and soften the stone, nor to separate it into a number of pieces at random^m; their way of cleaving it is this: Having pitched on a rock of proper size, they line it out, and in the lines sink with a pointed instrument, called a pick, several holes, about three inches deep, as many wide, and four or five inches long. Having prepared these holes, they insert a large iron wedge, called a gad, in each hole, and line the wedges on each side with a thin piece of iron plate; two of the masons then (each furnished with a fledge) drive the wedges in an equable manner, and the stone will cleave the whole length desired.

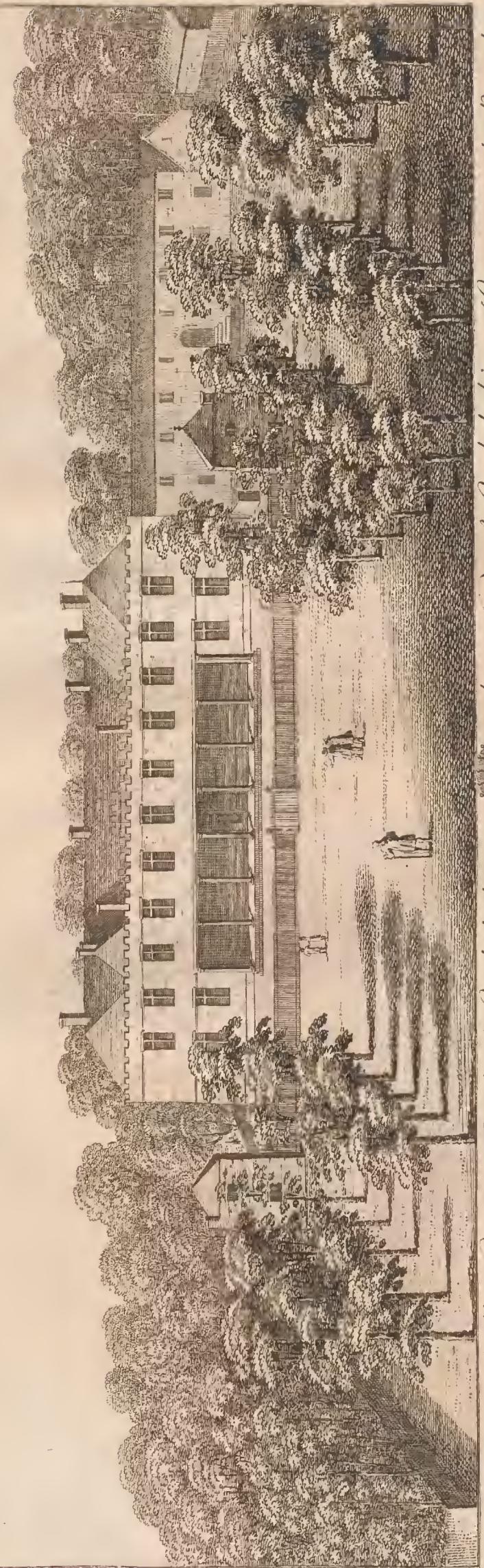
That this stone is of the same nature with the Oriental granite, is now no longer to be disputed; by that name therefore, as better known, I shall henceforth distinguish it, and range the several sorts I have met with in Cornwall according to the several colours of their *grounds*: for perspicuity sake, let the reader observe, that in such compound stones as this, the prevailing matter or cement of any stone is called the *ground* of that stone, and the spots, veins, or variegations fixed in that cement, I shall call the *charge* of that stone, as we might with equal propriety (if it were not to multiply names) call the *ground* of any stone the *field* of that stone.

Five sorts of this granite I have observed, the white, the dusky or dove-coloured, the yellow, the red, and the black.

White.

In the parish of Constantine, in the Hundred of Kerrier, there is great plenty of this stone; the *ground* of several degrees of whiteness; the whitest of all, which is the best, consists (as to its *ground*) of milk-white opake, tabulated, glossy grains of quartz, the grains rectangular, and usually columnar, from the fourth of an inch and less in diameter; the *charge* consists of brown and bright silvery *micæ* of talc, about the tenth of an inch diameter; the *ground* is so white, that the brown talc has the appearance of black, when it is near and fronts the eye; but at a little distance, the *ground* prevails so much, that this stone, for many years after it is wrought, looks absolutely white: it is of a close grit, cuts well into moldings, in a moderate fire grows somewhat whiter and more brittle, but without mixture will not vitrify in a strong fire, gives fire with steel, ferments not with *aqua fortis*: it has a very good effect in

^m Hill's Fossils, page 499.



To the R^t Hon^{le} Francis Earl of Godolphin whose
of Breag, Cornwall, engraved at his expence
this view of Godolphin House in the Parish
is most gratefully inscribed by
W^m Borlase.



building, is free in working, yet hard enough for every kind of stone-work in water as well as out, and much superioür to Portland for steps and water-works: it is also sent rough-hewn to Bristol in large slabs, which are there further polished for casting thin broad plates of copper. The pyramid in Arwinek grove at Falmouth, is solid, and built of this stone. It was erected by the late Martin Killigrew of Arwinek, Esq; in the years 1737 and 1738, at the expence of 455 Pounds, fourteen feet wide at the bottom, and forty feet high, each side correspondent in number and size of stones to the front here exhibited, Plate XXIV. Fig. vii. the middle layed with roughly-squared stones, and their interstices filled with liquid cement; so that a more durable work can scarcely be imagined; and great pity it is, that it was not placed as conspicuous as its solidity deserves. Gentlemen face the fronts of their houses with this stone to good effect, as may be seen at Carclew, the seat of William Lemon, Esq; Plate XI. page 96, and other places. Of two specimens weighed in the hydrostatic balance, one weighed to water as $2 - - \frac{5}{6}$ ⁸ to 1, the other weighed only as $2 - - \frac{10}{11}$ ⁷ to 1ⁿ. There is a very good granite of the same kind in Karn-mël-bal in St. Just.

In the parish of Madern there is a very pretty moorstone, but rare; the *ground* milk-white, glossy quartz or coarse crystal, the *charge* consisting of large black spots of cockle. Rochrock, in the parish of Roch, differs only from this, that the *charge* is small black specks, from the tenth of an inch and under, very numerous, thickly and equally dispersed, so as to be of a mottled colour: this stone is in large masses. The tenderest and freest kind of this stone, and neatest for moldings, is that of Tregonin, in the Parish of Brêag, of which is built the portico of Godolphin house, the seat of the Right Honourable the Earl of Godolphin, Plate XII. and the New Church at Helston, the donation of the same munificent Lord. The *ground* is of a white, opake grit, tender almost as clay, interspersed with granules of quartz, cinereous, transparent, laminated, small from the eighth of an inch and under. The stone is soft, and easy for working, especially when first raised, but afterwards hard and lasting; extreamly white when newly wrought, but apt to contract a mossy green hue in time. It weighs to water as $2 - - \frac{29}{63}$ ²⁹ to 1. Of all the granite kind in Cornwall, this, if I have been rightly informed by a gentleman who has tried many experiments this way, is most proper for making porcelain.

In the parish of Ludgvan^p there is a singular kind of granite; Dove-coloured.

ⁿ By which, as well as many other experiments, it appears, that in parts of the very same concrete stone the *ground* and *charge* are mixed in different proportions, and that there is no determining precisely, but only in general and at a medium, the

weight of any sort of stone by experiments made upon any specimen.

^o Mr. Cookworthy of Plymouth.

^p Reciūs Ludyon.

the *ground* dove-coloured transparent quartz, the grain from one-sixth of an inch diameter downwards : there is a crystalline, farinaceous, small sand, inclosed betwixt the grains, with a vast quantity of filvery talc interspersed ; at the distance of two inches, generally more, is a spot of black cockle, half inch or under in diameter ; when the spots are larger, they are more distant. It is commonly called the Silver Stone ; and indeed is of great lustre in the microscope, every other granite placed by its side looking flat and tame. It is much coveted for walling in ashler-work, being tough, keeping a good edge, and working easy. One specimen weighed to water as $2 - \frac{84}{129}$ to 1 ; the second, of a more yellow *ground*, weighed more, *viz.* as $2 - \frac{82}{110}$ to 1. It imbibes water strongly, makes no effervescence with acids, gives fire with steel ; being calcined, the black spots go off, even in a small fire ; the talc will perpetually keep its colour, though the other parts grow brown with age ; perhaps it might do very well for silvering *grounds* for paper-hangings, and all the uses of talc.

Yellow granite. Of yellow granite there is a great quantity ; the *ground* brown-yellow, speckled throughout with black foliaceous talc of the fourth of an inch diameter and under ; the *charge* dark, cloudy, many grains of cockle from the fourth of an inch and under in diameter, intermixed with large, toothy, whitish, opake prisms of quartz, from an inch and half long by an inch wide and under. The *ground* of this stone being so porous, and the *charges* so frequent, large and hard, make it one of the most shattery granites we have, fit only for rough works, where neither squares, sharp edges, nor moldings are required. It weighs to water as $2 - \frac{84}{145}$ to 1 : it imbibes water strongly, and discharges it as suddenly ; so that walls of it must be very damp.

Much better is the yellow granite of Tregonin. Its *ground* is yellow, and being somewhat earthy, not more firm than the former ; but then the grains of its *charge* are but from the sixth of an inch diameter downwards, and its black specks of talc from the eighth of an inch diameter and under, seeded so thick, as to be seldom more than the eighth of an inch distant. This is a very beautiful stone, works as well as the white Tregonin before-mentioned, and is therefore reckoned among our best granites ; although I must observe, that the *ground* is so very earthy and tender in both, that it can never bear a high polish. It weighs to water nearly as the white of this place, *viz.* as $2 - \frac{22}{113}$ to 1 : imbibes moisture strongly, but evaporates it slowly, and is therefore much dryer for walling than the foregoing.

Red granite. On the lands of Treasso, in the parish of Ludgvan, there is a granite of a red *ground*, quartz laminated with oblong, lucid, rhomboidal

rhomboidal scales, from the fourth of an inch diameter and under. The *charge* consists of dusky cinereous granules, in some places dark and fibrous as cockle, not only granulated, but veined; the *ground* and *charge* equally hard. This stone at Treasso is exactly the same in structure and colour as the red Egyptian granite, and lies in a vein about a bow-shot from the house, crossing the publick road which leads to Castelandinas, and may prove better at depth than at the top, where I found it. It weighs to water as $2 \frac{77}{140}$ to one.

Of a richer kind is the red granite first taken notice of by the discerning Right Honourable Lord Edgcumbe, by whose directions tables were first made of it, and very handsome stands for busts and vases. In the new hall, at Mount Edgcumbe, have been lately erected two chimney-pieces principally of this kind of stone; and indeed to this noble Lord this best of our Cornish granites remarkable for its bold ruddy colouring and high and durable polish, is chiefly indebted for being rescued from obscurity, and estimated at so high a price as it is at present by the curious.

In the parish of Ludgvan there is a granite of a black cockle Black granite *ground*, charged so thick with white spots of semitransparent quartz, from an inch long by half inch wide and under; that the *charge* almost rivals the *ground* in quantity, it is much harder than the dove-coloured granite of the same parish, and weighs to water as $2 \frac{108}{137}$ to one.

A better stone of the black kind is found at Bosworlas, in the parish of St. Just; the *ground* is of a blacker cockle than the foregoing, and is intersected in all directions by toothy masses of a warm flesh-coloured quartz, mostly in the parallelopiped shape; sometimes curved, now and then in a zig-zag manner, and sometimes in the form of a cross; in diameter, from half to one-sixth of an inch, by two inches long and under. The *charge* in depth consists of two *strata* (sometimes three) of *laminæ*, from the twentieth of an inch thick and under, with lucid surfaces parallel to one another, but lying at different angles with those of the adjoining *stratum*; so that when one is opposed to the light and shines, the other, which abutts at the end of it, does not. This is a most curious and beautiful stone, extremely hard, may be had in large pieces, and will doubtless with labour attain to a high polish for tables and ornaments. It weighs to water as $2 \frac{85}{129}$ to 1.

The marble we have in Cornwall is not remarkable either for its SECT. VIII. beauty or use. In the parish of Carantoc, and at New Kaye, in Lower St. Columb, there is a coarse cinereous marble veined with white spar: it ferments strongly with *aqua fortis*, gives no fire with

steel, weighs to water as $2 - \frac{9}{13}^8$ to 1. The specimen weighed in air fifteen penny-weights ten grains; and after being immersed three minutes, and carefully wiped, it weighed fifteen penny-weights ten grains and half, by which it appears, that this marble admitted no water at all into its pores. It burns to a whiter colour, but makes no sign of fermenting afterwards, when sprinkled with common water. Much better is the marble about a mile north of Padstow, at a place called Pormissen, where there are in the cliff great quantities of marble, the *strata* one foot and half thick at a medium, intermixed with shelfy flat; the marble is sometimes cut into chimney-pieces and tables, makes slabs for hearths, and small squares for inserting between the angles of free-stone pavements; the ground of it somewhat blacker than the foregoing, and the veins wider; as to the *ground*, grit, texture, finer and closer; the fermentations with acids the same⁴: it takes a very high polish, but so hard withal, that perhaps Italian marble is full as cheap*. Among the Cornish marbles, according to Linnæus's System, (see page 156) we must reckon a fine gypsum or plaster of Paris, discovered lately in the parish of St. Clare, near Liskerd, equal to any thing of that kind found abroad.

SECT. IX. It may not be here unseasonable to add a remark or two Of the weight upon the weight and dampness of stones in general, and of the and dampness⁵ foregoings in particular. As by weighing them in water of stones.

we discovered their specific gravity nearly, with regard to one another and to the common standard-water; so by weighing them carefully wiped after their immersion, we may perceive what quantity of water has entered their pores, and in what time, which may lead us to some useful observations; and, among the rest, to estimate the dampness of each sort of stone in walls and pavements; for according to the quantity of water imbibed in any given time, and its slowness or readiness to remit and evaporate that moisture, so will be the dampness of any wall built of that stone with like and equal cement. If it retains as well as imbibes, then it must be saturated with water before it can occasion any damp; and therefore the free-stone of Carantok, and any other of like nature⁶, imbibing freely, and retaining greedily, will suck entirely into its body all the common moisture of the air and cement, and keep it there without imparting any perceivable quantity to the inside of the wall or room. If it imbibes water suddenly and as readily parts with it, as some of our granites do, it will infallibly occasion damps within and without; it will disperse it's dampness inwards, yielding it to the

⁴ Dr. Woodward takes notice of marble nodules variegated with brown, red, and white, from the shores of the Land's End. Cat. A x, b 7.

* There is a blue-black stone of a marble texture found on Gunhill downs; I have noted it

also in the parish of Kilkhampton: it cuts into neat moldings, and bears carving: it will not ferment with acids.

⁵ Portland, Bath, and Oxford.

attraction

attraction of the greater heat within a room or wall, than there is on the outside of the wall. If it be so hard that it will not admit of any water into its pores, which is the case of some marbles, it will however occasion great damps, by condensing the moisture of the air (which would otherwise gently disperse and vanish) into water, to such a degree, that pavements, ornaments and pannels, of such marble, shall sweat (as the usual phrase is) and even run with water. It being the usual and just method to line walls with brick, to make the walls wholesome and dry, in order to discover by what means bricks obviate damps, I made the following experiments in July, 1755. I took two bits from off the same brick, of the closest and most uniform texture; N°. 1. weighed in air, 314 grains; after it had been immersed five minutes in water, it weighed (after being carefully wiped with a linen cloth) 368 grains, so that it imbibed, by an immersion of five minutes, 54 grains, which to its whole is as one-fifth - - $\frac{44}{54}$.

N°. 2, weighed in air 326 grains, but after an immersion of five minutes, 392 grains, having imbibed 66 grains; the same brick having one of its angles placed contiguous to some drops of water, sucked up still more; a third specimen of like consistence, which had not been immersed at all, on touching some drops of water sucked them out of sight immediately. By these experiments it is plain, that brick does not obviate damps by its aversion to, or repulsion of water, because it imbibes water more rapaciously than any stone.

I placed therefore both these pieces of brick so charged with water, in a South dry window, July 15, 1755, at nine o'clock, a. m.; by twelve at noon N°. 1 had evaporated five grains, by half past three, p. m. it had lost five grains more; at five it had rather gained than lost (the weather proving rainy); by three quarters after six, p. m. it had lost only half a grain in three hours and a quarter, the weather continuing cloudy, with some rain; at half hour after five the next morning, July 16, it had lost more, four grains and a half, and by nine, a. m. which compleated the 24 hours, it had lost more, four grains; so that in 24 hours this piece of brick had evaporated by natural heat, nineteen grains, which, to fifty-four, the quantity imbibed is somewhat more than one third.

N°. 2 had been purposely for a moment or two, put contiguous to water again, to try if it would imbibe more moisture than its immersion had supplied it with, and yet in 24 hours, this specimen evaporated only sixteen grains, viz. one quarter and two sixteenths of what it had imbibed.

So retentive is brick of that moisture which it admits; by which it appears that brick obviates damps, not by resisting or defending

* See Carantoc marble above.

the moisture of weather, improper stones, and broken cement, but by first imbibing strongly, then arresting and detaining the damps, and draining the cement so as that it cannot transmit its dampness through the walls: this brick will do till it is saturated with redundant moisture, and then it obviates damps no longer; and it follows, that the more our granites partake of the nature of bricks, the dryer they are for walling; on the other hand, the more they admit and condense, and the easier they quit and disperse the moisture they receive, the greater damps they occasion, keeping the body of the cement, and every thing contiguous, in a continual unwholesome state of moisture.

C H A P. X.

Of Stones of Ornament and Curiosity, viz. Pebbles, Flints, Porphyry, Talc, Stalactites, Asbestos, and small Gems found in Cornwall.

THERE are no gravel pits where pebbles and flints lie in heaps and *strata* at present discovered in Cornwall, which have reached my knowledge, but nature has made sufficient amends by bestrewing the beach of our bays and creeks with an infinite number of pebbles, flints, and nodules. Here therefore the curious Naturalist will find, spread as it were for his better observation, a large collection, wherein, though there are many duplicates, yet is there a greater diversity of curious stones on a beach of a few furlongs, than are to be found in some hundreds of miles, travelled over in the inland country. When the learned travel, they only take notice of, and collect what is rare to them, or not yet described; whence it happens oftentimes, that those things which are reckoned among the most entertaining products of nature in other countries, lie on our own shores neglected, merely because they are well known to the Literati, and found in other places by the occasional visitors of this, and other particular counties.

I shall range the pebbles by the colour of their *grounds* as I have done before by the granites.

SECT. I. N°. I. Of the white pebbles some are veined like marble, some clouded with a lively flesh-colour, some variegated with purple and other spots, as well as veined, others charged with black pebbles, some rough and gritty to the touch, others smooth, some transparent as rock crystal. Of this last sort I have seen a seal cut out of (what the lapidaries call) Pebble Crystal, extreamly bright and clear: the pebble was found, as I am informed, on the top of Routor,

the

the highest hill in Cornwall according to my estimate^t. It is also found in our mines, but seldom; the only one I have seen was taken out of a mine, called Huel-royal, in Camborn; it was quite ovular, half uncovered and half fixed in a socket of angular and puculated crystal; one inch and half long, and one inch and one-fifth wide: but our white pebbles are mostly of an opake white quartz.

N°. 2. Of the yellow kind our pebbles are usually of a high polish and amber-like substance, differently clouded, veined, or spotted, with other colours.

N°. 3. Pebbles of a green ground are rare with us, none which I have met with transparent; in some the willow-green is charged with pale-yellow crystalline granules, the *charge* prominent, shewing that it is of a harder firmer consistence than the *ground*.

N°. 4. Of the ruddy *ground* some of a faint lake-colour have large irregular granules of opake white quartz sunk in them, thereby approving themselves softer than the *ground*.

Of the brown-red some are of a high polish, fine texture, clouded with red intersected by a blackish vein, plainly of the agate kind.

N°. 5. Pebbles of the blue *ground* are very differently charged; one of a blue killas is seeded with innumerable little micaceous spots, of so faint a cast as scarce distinguishable from the *ground*, the *charge* a thin sprinkling of opake white quartz; the stone is porous, and to the touch feels rough, as any granite pebble.

Another of blue killas is charged with pale, flesh-coloured, toothy grains, from an inch diameter and under, and differs only from the Bosworlas granites (beforementioned page, 101) in this, that its *ground* is blue instead of black.

Of a blue-black, some are of a very high polish, and close texture.

N°. 6. Of the black ground, some pebbles are so equal a mixture of striated glossy cockle and white quartz, that were not the latter in distinct granules from the fourth of an inch and under, it would be difficult to decide which is the *ground* and which the *charge*; it is a pretty mottled stone, but rough and scabrous to the touch.

A black flattish pebble, smooth, but of no great polish; its fibres parallel and longitudinal; it has the properties of a true touch-stone. It was brought me from the sea-shore in the parish of St. Kevran, and seems to owe its pebbly figure to the attrition of the waters; so that it is not unlikely that there should be thereabouts some course of black marble of the nature of the *lapis Lydius*,

^t In Oxfordshire they sometimes find such pebbles wholly pellucid, about the bigness of a wallnut. Woodward's Cat. vol. I. page 32.

or Chian marble of the ancients; although any black hard marble will indeed answer the purposes of a touch-stone.

N^o. 7. Jaspers are to be found among our pebbles, more especially of the black and yellow kind; but of the green jasper I have yet seen none found in this county.

SECT. II. It has been generally held by Naturalists that we have no flints native in Cornwall, but this is a mistake. Betwixt the towns of Penzance and Marazion there is a beach of pebbles two miles and three quarters long, among which many hundred flints may be picked up every day; and lest it should be insinuated that these flints may possibly be foreign, and brought in ballast by ships, I must observe, that in the low-lands of the parish of Ludgvan, scarce a musket-shot from the said beach, in a place called the Vorlas, there is a *stratum* of clay about three feet under the grass: the clay is about four feet deep. In this clay, immersed from one to four feet deep, (sometimes deeper) flints are discovered in great numbers, their size from the bigness of a man's fist to that of a bean, their coat nearly of the colour of the clay, (as in chalk we find their exterior infected with the chalk-bed in which they lie) and their inward part died with the same colour more than half way; the other part, near the middle, a common, corneous, brown flint. In the same bed of clay, I find sea-pebbles of opake white quartz, and some shingle; sufficient and evident vestiges of the universal deluge. I find also many small blue killas stones, with all their angles on; an equal evidence, that as the advancing waters of the deluge introduced the productions of the sea, so the departing waters of the same catastrophe frequently deposited stones and fragments of stones from the hills: both shew, that the *stratum* remains as it was left by the flood, and are consequently testimonies that the flints found in it must be native, and the growth of Cornwall. The flints of this bed of clay are brown within, but on the beach we have a remarkable variety, and one now before me of an opake white, is of as fine texture, and as high a polish, as any Carnelian I have ever seen.

SECT. III. Pebbles found on the sea-shore are generally of the same flattish oval shape. This shape is therefore attributed (and for the most part not unjustly) to the agitation of the sea, which, by continually rolling them to and fro, against the rocks and against one another, wears off the angles, and necessarily reduces them to their globular figure: but what exercises the attention of the curious, is, that pebbles are oftentimes found in clay and gravel-pits many miles from the sea, and yet of the same orbicular shape as those on the sea-

Shape and varieties of pebbles, and their cause enquired into

sea-shore; nay, some of these inland pebbles are sometimes large from ten to twenty inches, and some three and four feet diameter. The question therefore is, Whence this similarity of shape? How come the inland pebbles to be of that shape, which, in such numerous instances as the sea-shore and rivers afford us, is manifestly owing only to the agitation of sea and river-waters. Dr. Woodward (who left few parts of Natural History unattempted, and many particulars very successfully explained) labours hard to prove, that the inland pebbles are indebted to the departing waters of the Deluge for their roundness; and that these waters had the same effect upon them as the sea upon those of the shores: but it is very justly replied to this opinion, that the departing waters of the deluge had neither time nor sufficient force in general, nor violence of agitation enough in all situations to produce the effect in question; the cause therefore assigned is not equal to the effect, and all the phænomena in pebbles produced by him^u, may be rationally accounted for upon much less disputable principles^v. The truth is, this pebbly form is either natural or adventitious; where the form is adventitious, it is owing either to the force of sea or river-waters; on the sea and river-beach those pebbles of the softer kinds, and those which appear to have been fragments of the adjoining rocks (or nodules which never arrive to the size of rocks) owe their roundness to the neighbouring waves; at the same time it must be confessed, that many which are on the shore, as well as most of the inland pebbles, are really found in their own original, and natural form in which they first concreted. Natural pebbles may be safely distinguished from factitious; first, by their having a coat or shell mostly of an even thickness, but of a different colour from the inward substance of the stone; secondly, when the pebble has a nucleus in or near the center, round which the body of the pebble is formed in *strata*; thirdly, when the fibres of the body spring like rays from a central point; fourthly, those pebbles, which have nodulous bunches or excrescencies of equal hardness to the rest of the body, may be looked upon as in the same state and figure which nature left them in; fifthly, if a pebble ferments with acids, it is not a natural one (Hill, page 406); but whether this criterion be conclusive may be questioned; for I cannot see why stones of a sparry base may not be formed into a pebbly figure by the same

^u *Ibidem ut supra & passim.*

^v The stone which Dr. Woodward (*ibidem ut supra*, page 47,) lays so much stress upon, may be explained without having recourse to the departing waters of the deluge. This stone consists of several small pebbles cemented together into one nodule. No more need be said, than that the *ground* and the *charge* might be liquefied at the

same time; and though by the attraction of similar parts the little pebbles were kept together in separate masses, and the cement, at the same time that it surrounded them, repelled them to their own limits, yet being both supple enough to conform to the force of external bodies, they became compressed and rounded, and formed one nodule under one convex surface.

principle

principle which forms those of a crystal base, that principle being adventitious, not natural to either: however that be, it must not be imagined, that the reverse will hold good*; for we have many factitious pebbles (of Porphyry for instance, and others of crystalline base) which will not ferment. To these criterions some authors add, that they break irregularly^x; whereas factitious pebbles break to faces. How this natural figure therefore comes to correspond so perfectly with that which is factitious, must be our next enquiry. A modern author observes, that one part of the pebbles is more compressed than the other, which he therefore rightly terms their base, and argues very justly, that the lumps of which they are formed, must have been at one time or other in a state of softness and liquidity; that, floating in a fluid medium before they were hardened, they were rolled to and fro, if that medium was in violent motion, so as to become round; if that medium was in little motion, then they only became roundish; if at perfect rest, then still more flat. These are ingenious conjectures, and the author deserves commendation; but there must have been several other concurring causes: To what is here suggested then, let us add the equal pressure of the fluid medium on all sides upon the stone-masses during their liquefient state; for we know that water will form melted lead, properly mixed, into a globular figure: Again; the mutual attraction of similar parts will form fluid bodies into a roundness, as we may see by drops of dew and quicksilver. All these causes must, I should think, be admitted; nor are we to forget, that the innate force of the materials, the peculiar salt, sulphur, mineral, or metallick earth, of which the stone is composed, must have been supple, and complying with the other forces, and not have any tendency to angular or rectilinear figures, or pebbles could not have been rounded at the time of their concretion.

Thus much for the natural and factitious shape of pebbles, the latter being occasioned by the agitation of water, and the natural formed in water, partly by its fluctuations and equilateral pressure, and partly by the mutual attraction and consent of the *moleculæ*, of which such stones are composed. As to the other properties of pebbles, whereby they differ from one another, I shall only hint, that if the component parts were smooth, fine, and small, the body formed of these will be of a close texture and glossy surface; if we find the inward structure uniform, it will intimate the unmixed nature of the materials; if in layers of different earth and cement, we are to impute them to successive applications of different substances, indurated at different but no very distant times;

* That all pebbles, which will not ferment, are natural ones.

^x Dr. Woodward's Catalogue, vol. I. page 29.

✓ Hill's History of Fossils of the Telaugium,
page 555, &c.

if they are intersected by seams of stone different from the body, the reason possibly may be this; that as the body was contracting itself in order to induration (contraction or approximation of parts being a necessary concomitant of induration), or after induration cleaved by force of fire or accident, a fissure ensuing, that fissure was filled with the adjoining matter, repelled by the substance of the body, and formed of its own uniform parts by mutual attraction betwixt themselves and exclusion of others. If there are unevennesses in the surface of pebbles (as was the case with many, which made Dr. Woodward recur to the agitation of the waters of the deluge) some parts being more prominent than others, or if there are loose nucleus's inclosed within the central cavity, as is the case of the *Ætites*^z, it need only be suggested, that these phænomena may reasonably be attributed to the different contractile powers of the materials of which these unevennesses and central nucleus's consist; it being certain, that if the body of a stone contracts itself, in order to induration, into a closer substance than the seam, *septum*, or granulated *charge*, that *charge* or seam will be more prominent than the body, and *vice versa*; and if the substance of the nucleus, during the time of induration, contracts itself after and more than the substance of the shell which invests it, that nucleus will have a vacancy round it, and become loose in its cell, the nucleus being a concretion posterior to that of the shell, and breaking loose from the inner coat of the shell by the contractile powers of its own constituent parts. Lastly, of pebbles: Some are evidently formed since the deluge, for we find shells, coralloid bodies, and echinites in them; whether those which carry no such evidences were formed before, at, or long since the deluge, it is impossible to determine.

From pebbles, let us pass to nodules of curious stones found in SECT. IV. Cornwall. Having found some pebbles of porphyry on the sea-shore, upon farther search I discovered a stone of the same kind in the parish of Philac, among the sand-hills: it is of a ruddy-purple *ground* (not so red as the Egyptian) charged with granules rectangular and oval, from the eighth of an inch diameter and under, nearly of the same colour with the *ground*, but paler with glossy surfaces, interspersed thinly with opaque white granules of quartz of like size and shape to the foregoing, mixed with some black specks of cockle of the same size. It weighs to water as $2 - \frac{84}{126}$ to 1^{a} .

No. ii. Part of a large nodule of like porphyry found in my garden, had its granules larger, but no white interspersed. One

^z One of which, of a hard brown flint-like stone, about an inch in diameter, was found in 1757, near Penzance Kaye, among the sea-pebbles,

and brought me September 17, 1757.

^a This seems to be the pophyrites leucostictos of the ancients.

pebble of like kind is charged with yellow spots of a light-ochre colour, from the sixth of an inch diameter and under,

N°. iii. A very blue violet purple *ground*, granules lighter coloured, thinly dispersed from the eighth of an inch and under in diameter, a beautiful stone from the beach in Mount's-Bay.

N°. iv. We have also the porphyrites with larger grains, and a green *ground*, which stone though not of a purple colour, yet, being of like consistence and texture, must be ranged also among the porphyrites.

N°. v. Dr. Woodward takes notice of "a stone ^b finely variegated with spots of red and white, with flakes of white talc in it, found near Calfstock, in Cornwall, called with us the Worm-Seed Stone, because thick set with small bodies not unlike the Semen Santonici, or Worm-Seed, somewhat related (says he) to the porphyry kind."

I have yet found these porphyries only in nodules; but so many being to be seen, especially after a storm, on the sea-shore of Mounts Bay, particularly near Pons-an-dane river, in Gulval, it is not unlikely that there may be some veins or *strata* of them in the funk rocks under the sea, though I have, upon my searches among the rocks at low-water, not discovered any. The porphyry was thought formerly peculiar to Egypt, and much admired for its colour and hardness. The ancients had a method of working it with tools, but that method is as yet unknown to the moderns. It is a closer-grained kind of granite, with its *charge* or spots more neatly placed, and more distinctly finished.

SECT. V. It has been generally held, that in Cornwall we have no stalactites, but this is a mistake; for some small drop-stones or stalactites and alabaster ^{and alabaster} have been sent to the Royal Society from Pendinas castle, said to be in Cornwall.

have had a strong scent ^c; and in the caves of a cliff, near the Holy-well, in the parish of St. Cuthbert, there are several stillatitious productions of a sparry kind. Some are gritty, and their grit little harder than chalk; others are more stony, and hang from the roof in fangs, like the anemone root, but sometimes in small tubular stalactites with green and sometimes red efflorescencies. The same sparry juice forms large bunches of stone on the sides of the caves, and as it drains through the sand, and blown fragments of shells, fixes both, forming itself into thin prominent wavy edges, with quadrangular cavities between, making a pretty kind of fret-work. On the floor of these caves the same stony juice forms a more uniform mass, spreading itself into a fluor of the alabaster

^b Cat. vol. I. page 64, d. 36.

^c Grew's Mus. R. S. page 320.

kind

kind. The *strata* of this incrustation are as many as the successive indurations, easily distinguished, the under-part of each *stratum* being browner and more earthy, the upper-part more white and pure, the more impure parts of the liquid settling nearest the bottom. The samples I have from these caves, are from half inch to six inches thick, coating the protuberances, as well as the depressions of the rocks they fall upon, usually at one thickness; but where the rock upon which this fluor fixes is concave, and the edges of that concavity upon a level, the alabaster is thicker, better clouded, and of a closer grain, and consequently fitter for polishing, and making larger vases. The upper-parts of the incrustation is covered over with a kind of purple powder, a sort of mineral efflorescence^a, calcarious, fermenting strongly with acids^b; in the microscope it appears woolly, and like the shoots of damp vitriolic substances; but that the filaments which shoot from vitriol are white, and the threads of this salt are transparent purple crossing each other in all directions.

The learned Mr. Ray mentions the warming-stone digged in SECT. VI. Cornwall, which, being once well heated at the fire, retains its Warming-warmth a great while. Dr. Plot (Oxfordshire, page 258) says this stone will continue warm eight or ten hours^c, and gives relief in several pains, particularly in those of the internal hæmorrhoids; and Charlton de foss. Onomast. Zoicon. page 243, calls it, *Lapis Schistos duriss. & solidissimus apud Cornubienses* Warming-stone. In Yorkshire they have a stone of this property, consisting of dark-grey glossy talk with some white spar interposed betwixt the flakes of it, which, Dr. Woodward (Cat. vol. I. page 62, O d. 7 †.) says, the people lay in their beds in cold weather at their feet, because, when once heated, it retains the heat a great while^d.

In a copper-mine, called Nancothan, near Redruth, they have Swimming-a stone which they call the Swimming-stone. It consists of rectilinear *laminæ* as thin as paper, intersecting each other in all directions, and leaving unequal cavities of various angles between the *septa*. The structure is therefore very cellular, and makes the stone so light, that it swims on water. It is of a yellow goffan colour, and as to its exterior, has some resemblance to a light kind of cavernous *lapis calaminaris*, which I have had from Wirksworth, near Derby. I have not heard of this stone's being found any where in Cornwall but in this work.

^a Supposed to be the flowers of cobalt.

^b I have observed the same purple efflorescences on a damp stuccoed wall in the chapel at St. Michael's Mount.

^c In which quality however it is inferior to the Spanish Ruggiola (mentioned in Willughby's

travels through Spain, page 471), which are broad plates, like tiles, cut out of a mountain of red salt near Cardona, which, being well heated on both sides, will keep warm twenty-four hours.

^d Hill, page 553, calls this stone the blueish white brittle Telaugium.

SECT. VII.
Of talc in Cornwall.

Of the brown foliaceous talc, a tin-work, in the parish of St. Just^h, affords a fair specimen; the leaves thin and elastic from the fourth of an inch downwards in diameter, of no determinate figure, nor inserted in any order. In the microscope the leaves are of a tortoise-shell transparency and colour. It is found in a bed of ruddy speckled granite, to which it adheresⁱ.

N°. ii. A much more beautiful foliaceous talc I have from a cliff near the Lizherd, of extream thinness, fine texture, transparency, and silver hue: the leaves were in diameter but half inch downwards, being broken smaller than their natural size before I had them. It is the *Mica particulis membranaceis fissilibus diaphanis**.

N°. iii. A specimen of the same kind of a browner, more corneous colour, less flexible, and its membranes larger^k.

N°. iv. Radiated silvery talc. In a bed of milk-white tabulated quartz. The rays are an inch and a quarter long and under, consisting of several membranes of talc one-fourth of an inch long by one-sixth of an inch wide, in the shape of the leaf of a peach-tree: they lie in straight lines, springing as it were from a centre^j.

N°. v. The shining gold-coloured talc, or *mica aurea*. The micæ are of silver as well as gold-colour, but less distinct; neither of them elastic: they lie longitudinally in parallel flakes, one on the back of another, and between them have white crystalline shivers; but what part of Cornwall I had this from, I do not recollect.

SECT. VIII. Of the solid asbestos talc we have before taken notice, that it is sometimes found adhering to the purest specimens of the steatites *Cornubiensis*, or Soap-rock. The same substance is spread like an enamel on the surface of the rocks exposed to the sea. This is near of kin to the Ophites, or Serpentine marble of the ancients, and sometimes is but a thin film, a kind of enamel, shiver, or crust; but where it is in larger and more stony masses, it admits a high polish, is cut into various forms, and turned into vases^m.

Of the fibrous asbestos I have a sample found in a stone in the church yard of Landawinek, the filaments flat, pointed, of a bright purple colour, and silvery gloss, extremely small and flexible, appearing in the microscope edged with a soft down, the fibres longer and of a brighter hue, but not so woolly as some samples I have from the isle of Anglesea. In greater plenty I have received specimens of

^h Huelanboys.

ⁱ It seems the *Mica particulis squamosis sparsis* of Linnæus. Syst. Nat. page 159.

^{*} Linnæus Syst. Nat. ib.

^k From Gwenap.

^l From Bellchapel work, in Gwenap.

^m This should be the *Ollaris solidus virescens, maculosus polituram admittens* of Linnæus, page 160, N°. iii.

an asbestos lately found in the parish of St. Clare, near the town of Liskerd, by the Reverend Mr. Vosper, in the month of March 1756. It was first discovered about 150 yards, South-West of the church, in an orchard belonging to the vicarage, but afterwards in several stones of the adjacent grounds; some of it of a light yellow, adheres to the outside of a green hard sandy killas, this is short jointed, and not flexible, but it lies in veins generally, coursing in a wavy lineⁿ through the tender gritty cinereous killas before mentioned, page 92. The veins of N°. i. are of like colour to the mother stone, from the tenth of an inch to three inches wide; this is what is called by Authors^o the whitish brown silky asbestos, with long, continued flat filaments; it is not equally fine in all the stones wherein it appears; in some samples the asbestos is very downy, and the filaments rise flat and easily, from one inch to two inches and an half long. N°. ii. Is the amiantus *fibris mollibus parallelis facile separabilibus* of authors^p. N°. iii. is in its exterior like decayed willow wood; in other samples the fibres are three inches long, but more stony, rounder, more compact, and heavier, scarce at all plumous; this third sort I take to be the *Amiantos fibris durioribus in lamellas crassiores compactis ponderosus*^q.

There is another sort mentioned by Grew^r, called the “bastard amiantus which grows in veins in a clay and mundick load between beds of a greenish earth in our Cornish mines; the threads being one third or near half an inch long of a glossy black colour and brittle.” Of the more downy sorts of this stone, the ancients had the art of making a kind of cloth resembling linen, it had this singular property that no fire would injure it, for which reason it was called *Linum incombustibile*, and the use of it was to shroud the dead bodies of princes, so as to preserve their ashes pure, and unmixed from those of the funeral pile. Pliny lib. xix. chap. i. says, that he had seen napkins made of this linen which after being used at table, were thrown into the fire, and thereby cleaned better than if they had been washed with water. The ancients made also nets of this stone, and reticulated caps for the head; it was also used as wicks for lamps, in which it proved so retentive of the fire, that Callimachus at Athens dedicated a golden lamp to Minerva, which continued burning, by means of the lint of this stone immersed in oil, for a whole year without being extinguished: Pausanias in Atticis, chap. xxvi. A lamp of the same kind burnt in the temple of Jupiter Hammon^s. It is to be observed however, that wicks for lamps made of the asbestos do not yield so bright a flame

ⁿ See plate XXV. fig. xxx.

^o See Hill's fossils, page 102.

^p See Linnæus Syft. Nat. page 162.

^q See Linnæus, page 163, ibidem.

^r Musæum of the Royal Society, page 313.

^s Plutarch de def. Orac.

as those of cotton. This stone was very rare among the ancients; Pliny[†] seems to think that it was only to be found in the burning deserts of India, from the extremity of the heat in which climate it derived its quality of resisting the force of fire. He says, (*ibid.*) that it was so rare and precious, that the finding it was esteemed a piece of good fortune, equal to the discovery of precious stones, and calls the linen wove of it superior to any other in the world. Plutarch says it was found in Greece among the Carystian marble. It is now discovered in several parts of Europe, but whether so excellent as that of which the ancients made these curious linens it is hard to decide.

It may seem to some a little improbable that there should ever have been an art of extracting cloth out of stone, but when we consider the downy filaments of the asbestos, and the extream fineness of its fibres, so apt to mix and entangle one with the other, and make a kind of tender wool, it will seem little more surprizing than that cloth should be wove out of cotton. The art is supposed by some to have been lost in the time of Pliny, for what reason I cannot say; for, by the passage above-mentioned, it is clear, that the cloths made of it were extant, and in use in his time. Plutarch also mentions them as made in his time; and at present the curious try experiments in the same way for their amusement. “Septalius (says Grew, *Musæum, R. S.* page 313,) hath, or lately had, ropes, paper, and netted-works, all made hereof, and some of them with his own hand.” Whether the moderns understand the most efficacious manner of treating this stoney flax, is what cannot be determined; but their present manner of preparing it, is thus laid down by Pontoppidan, page 169, but from what authority is not mentioned: the stone is softened in water, then beaten with a moderate force till the fibres separate; afterwards carefully and repeatedly washed, till cleared of all terrene particles; then the flax is dried in a sieve; the filaments are then spun carefully, the fingers being softened with oil.” The reason why the art is lost, or rather disused, seems not so much owing to the want of this stone, nor to the difficulty of weaving it, as to the little or no demand for it, burning the dead (which was the principal use of it) having never been an universal custom in any even the most cultivated nations; and where it was a custom, few were so curious as to prevent the mixing of the ashes with those of the funeral pile, and fewer still were equal to the expence of procuring such costly cloathings for the dead; but when the Christian Religion prevailed over the Roman empire, and burning the dead was laid aside, then, and not

[†] *Ibid. ut supra.*

before, this art seems to have expired of itself, because the manufacture was of no longer use.

Here, as fitter to be ranged among stones of curiosity, than to SECT. IX. have a place among those of use or profit, I cannot pass by unnoticed Small gems of tin, and other stones. the beautiful gems which we find sometimes among the tin grains, although they are so small, that, to be viewed properly, they require the assistance of the microscope ; but they are not the less perfect, being as true gems, and of as high a lustre, as those that are larger.

N°. i. Among the tin grains found in Gofs-moor, in the parish of St. Columb, and those found in St. Austel-moor, I have found topazes very high-coloured, and some of a paler yellow gold-colour, very transparent, some zoned, about the twentieth of an inch diameter.

N°. ii. Some rubies also I have found pebbly formed, some light, and some of as strong red as a carbuncle.

N°. iii. Some of the ruby kind are mixed with yellow, and may therefore be ranged among the hyacinths.

N°. iv. A very small chrysolite of a very dark-green with a transparency of yellow.

N°. v. A very deep amethyst, pebbly formed, of the fifteenth of an inch. We have also hexagonal crystals of the amethystine kind, tinged strongly with purple, from our mines, sometimes an inch and more long ; but the finest lustre of this kind which I have yet seen in the Cornish stone, is inclosed in the body of the Polrudon stone^u, where the sparks are the tenth of an inch long and under ; but whether these are so hard as to deserve the name of gems, I am not sufficiently satisfied.

All these are so small, that (it may be said) they are of no value, which is very true ; but my enquiries (unsuccessful I own in many particulars) I shall not think entirely fruitless, if they can but point out the way to farther and more happy discoveries ; these small sparks prove that such gems are to be found among our tin-ores : it may not be unworthy therefore the attention of my countrymen carefully to inspect the tin-grains of the smaller size found in stream-works, wherein they will probably find much larger than what I have here described, and such as may well compensate the labour of seeking.

N°. vi. One crystal I have coloured with the same brown and of as fine a lustre as the Kerry stones of Ireland, but of a much deeper tinge, and, as I take it, of the Beryl-crystal kind^w.

^u See before-mentioned page, 96.

^w See Hill's Fossils, page 178.

N°. vii. What we call Cornish diamonds are figured crystals, and among crystals we shall treat of them ; but some of our crystals are tinged with green : they are of the Emerald kind ; what I have seen came mostly from a copper-work in the parish of Camborn, called the Long-close : the Oriental emerald is a most beautiful gem ; for the occidental, the jewellers^x usually sell this tinged crystal, common crystal being as hard as the occidental emerald ; with us it is angular or columnar, but best when found in the pebble form, of which I have yet met none in Cornwall.

N°. viii. Some of our crystals are also of a sea-green or beryll colour, and the same which authors call the Pseudoberyllus : after burnt red-hot, they will retain their shining in the dark for a few minutes only, in this falling short of the smaragdus which shines a considerable time^y, but, like that, change their green into a pale sky-blue whilst hot, but recover their native colour as they cool.

N°. ix. But of our curious green stones, none come near the colour and polish of a green cupreous incrustation found in Huel-fortune, in the parish of Ludgvan. Its texture is stratous, crust within crust ; its surface puculated ; the tubercles which it forms on the stones, are sometimes an inch in diameter, sometimes small, and either perfectly round or truly oval ; the colour so deep a green, and so high a polish, that I have obliged several gentlemen with some to set in rings, for which nature has fitted them without the aid of a jeweller. This comes very near to the properties of the occidental turcois, and has been taken for such by Naturalists. I have, from the same place, this copper of a blueish green clouded, but the green appears even there in some parts, and in the greatest part of the specimens, the green is predominant and unmixed. The blue-turcois is generally esteemed a precious stone, but indeed no other than fossil bone, or ivory saturated with copper dissolved in an alkaline *menstruum* ; the green-turcois is the same substance intimately penetrated by a cupreous matter dissolved in an acid *menstruum*, but this precious stone from our Cornish mines is the ærugo or a plain solution of copper, as appears by its forming itself into threads and stratous incrustations^z. I have met with none of this kind of any value but from this work, and it has been found there only in one small cavity of about one foot and a half in diameter^z.

^x Hill, 596.

^y Dr. Grew's Mus. R. S. page 287.

^z "The turcois is much softer than crystal."

Grew's Mus. R. S. page 284.

^z Fig. xiv. and xv. Plate XXI. have their tubercles of this beautiful green enamel.

C H A P. XI.

Of the general basis of Stone, viz. Of Spar, Crystal, and Diamond.

THE RE is a kind of stony lapidific matter which runs through and mixes more or less with the substance of all stones, and may justly be esteemed the universal cement, by which earth and minerals are combined into all the several orders and species of stones, for when this cement is dissipated by fire, or dissolved by a *menstruum*, the stone becomes earth or metal; and ceases to be stone: it is of itself transparent and colourless, but when mixed, is found either of that colour which the materials it joins together were of before they became stone, or of that which any after infection from other bodies has imparted.

This cement is either spar, crystal, or diamond. These I shall not only treat of as being distinct stones, in figure, nature, and effect, but as one universal cement, running through and connecting all other stones in three degrees of purity and perfection. Thus for instance spar not only forms simple stones of its kind such as the *Lapis specularis*, double refracting and simple refracting spar, stalactites and the like, but is indeed the basis of a great number of compound stones, from the tenderest lithophytes to the hardest marbles. So again, crystal not only forms hexagonal columns, and cuspides, pyramids, and the like, but is the gluten, the connecting basis of slate, killas, granite, flint, porphyry, and the like; as diamond is also the base of gems. The state of spar is the most impure, its parts are calcarious, lax, dispersed, they ferment and give way to acids, are extracted, suspended, and washed away by common water, consequently the stones which it combines are soft, brittle, and easily dissolved; this is the case of all stalactical productions, of alabaster, free-stones, lime-stones, and most sorts of marbles, of which the cement is spar. But the cement of spar is not always equally weak, sometimes it will scarce ferment at all, gives fire with steel^b, and it approaches so near the state of crystal, in hardness, transparency, and figure, that it is justly called crystalline spar.

Crystal has nothing calcarious in it, its parts unite close and firmly, and consequently forms much harder stones than spar, with equal quantity of earth, sand, or whatever the *charge* or materials in gross may consist of, and this is the case of porphyry, granite, jasper, and other compound stones, (whose basis is crystal) as well

^b See the *Spatum compactum scintillans Linnæi Syst. Nat. gen. vi.* page 167.

as pure crystals ; and as spar approaches near to crystal, so does crystal oftentimes to the diamond, in hardness, lustre, and resisting of fire. The diamond is the basis of all gems, which in hardness and lustre exceed the state of crystal ; the diamond is therefore but another remove, and in a more eminent degree the same stone and cement in the utmost perfection, (and therefore rare) which in inferiour states of purity we call crystal and spar. To one of these three cements all stones whether simple or aggregate, may be said to owe their connexion and solidity ; a stone being nothing more than earth concreted by the intervention of cement, so as to acquire hardness and weight sufficient to denominate it a stone ^c.

If the stone will ferment with acids, soon dissolve, be easily pulverized, gives no fire with steel, and shews other evident symptoms of specifical softness, it is then either wholly spar, or of a spar basis ; on the other hand, if it resists acids, remains moderately firm under the hammer, and in a strong fire, mixed with alcaline salt, will turn into glass, upon collision with steel gives fire, and in the hands of the engraver shews evident signs of a superior hardnes, then it is either crystal or of a crystalline basis ^d.

Crystal is the softest of all perspicuous gems, whatever exceeds it therefore in hardness is a gem, and if by a still greater degree of purity than what is above-mentioned, the stone becomes specifically heavier, and of better lustre than any other meer stony bodies, and resists fire almost to immutability, then it is called a diamond, and all gems, the ruby, sapphir, and the rest, are but this diamond, substance tinged and reduced, as to lustre and hardnes, by some metalline admixture.

SECT. II. In Cornwall all the white, opake, common, hard stone, is called Spar ; erroneously it must be owned, for it is quartz, and not spar : but the Cornish are not singular in this point ; for if any thing could countenance error, they have the authority of the greatest lithologists in England (Mr. Lhuyd only excepted) of their side ^e. Indeed it must be acknowledged, that, till within these few years, the distinguishing characters of these two bodies have not been sufficiently noticed in England ; the late learned and ingenious Dr. Isaac Lawson was among the foremost of our countrymen who insisted upon their being treated always as really distinct and

^c See page 80, note b.

^d If it is not naturally figured and transparent, the Germans properly enough call it Quaritz; that is, a coarse, debased, opake, crystalline body, and not crystal. See page 91.

^e It is justly objected to Dr. Woodward, that he has confounded spar and crystal in all his treatises, without noting the obvious differences above-mentioned ; and we may say the same of others, particularly of the learned Dr. Grew (see his Mus. R. S. Part III. Chap. v.) though he had his acid menstruum always before him.



To M^r Grace Percival of PENDARVES
in Cornwall, this variety of Cornish Crystals
is with great respect inscribd. —



by Wm: Borlase.

different stones¹. That spar is suspended in all waters is likely, but in particular waters is evident, from the incrustations formed in water-pipes till in time they choak and can transmit no more; from petrified moss, and many other phænomena. That spar is also to be found in sea-water must certainly follow, from the sea's being open to and ready to receive all that which springs will convey into it; from spars being evaporated by great degrees of heat², and therefore capable of being again precipitated by winds and rain³. Hence, from the solution I mean of spar in common water, come all petrifactions, and most of our stalactical concretions, marbles, and free-stones, which will ferment with acids, of all which the basis is spar; hence also the new sparry productions perpetually forming and formed in proper nidus's, by spar being easily solved and dispersed, and as apt to coalesce again into stone upon the deserton of the water in which it is suspended. However, these sparry productions are not common with us, and spar by itself, transparent and unmixed, is very rarely found in this county.

Our crystals are in great plenty and variety: I shall consider them SECT. III.
either as plain or figured; for, even in the plain, there are some Cornish cry-
stal. varieties not unworthy our notice. By plain, (that is quartz⁴) I mean a mass of crystal which covets no particular form, but hardens into that figure to which the gravitation of its own parts, and the medium in which it forms determines it. Of this sort is that which fills the veins and interstices of the stony *strata*, and the white angular masses of single-dispersed stones common every where in Cornwall⁵. Of this sort also are the wavy processses of crystal, which, like so many flakes of ice, incrust the perpendicular sides of our karns of granites, Plate XIII. Fig. I. Of the plain sort are all crystal horizontal incrustations which coat-over stones, and hang in threads as they descend, reaching croſs the hollows from one tubercle to another⁶. Of this sort also may be reckoned all crystals of the blistered and mammillary kind, which end in one drop, and have their sides pressed into orbicular pustules by the weight of succeeding drops, as Plate XIII. Fig. II. Of the plain kind also are all crystal stalactites, of which I have some so perfect, which I received from a work, called the Pool, in the parish of Illogan, exhibited Plate XIII. Fig^s. III. and IV. that the

¹ "Hoc fructulum & alterum spati addidi quoniam haec duo fossilia [scil. spatum & quartzum] figurâ naturâ et effeſtu adeo difinēta animadverto hic in Anglia nullo modo discriminari." If. Lawson, M. D. ad auctorem, A. D. 1740.

² Hill's Foff. page 156.

³ See Woodward's Cat. vol. I. page 113, 116.

⁴ Quartz differs only from crystal, as before-

mentioned, in that it is not figured: it is radically the same stone; and therefore quartz is crystal, plain, not angularly figured; but yet has several varieties. "Lapides crystalli dieti a quartzo et spato solum figura differunt." Lin. Syft. Nat. p. 224.

⁵ See before, page 48.

⁶ Philosophical Transactions, on the Cornish diamonds, by the author. A. D. 1750.

formation

formation of them in the stalactical manner can admit of no dispute. They are of the colour of fine glew, transparent as gum-arabic, and to the eye of like texture ; they end in one drop as round as any drop of dew or rain whilst it hangs ready to fall. It breaks like flint into irregular, edgy splinters. In Fig. iv. one of the stalactical productions, *a, a*, was evidently wreathed and twisted from the usual perpendicularity, by some force (in the mine) either of fire, wind, or water. This must have happened whilst as yet it remained in its liquefcent tender state ; but the liquid was so stiff and clammy, that though the three pendant processes were connected by this force, yet the circumference of each process, its annular tumours, and the terminating drop of each stalactite, is plainly to be discerned. Among the plain-crystals I shall also reckon the pebble-crystal^m ; for this seems to owe its orbicular figure to nothing more than what is common to all bodies, I mean, the gravitation and mutual attraction of similar parts assisted or controuled by the medium in which these round masses formed. Crystal, in all these circumstances, has no uniformity of figure, gives no evidence of any inherent active principle, but suffers itself to be fashioned and molded by its own gravitation, by the *nidus* it rests in, or by the medium which surrounds it, and yet is perfect crystal, breaks irregularly, gives fire plentifully with steel, is very hard to the graver, and ferments not in the least with *aqua fortis*.

SECT. IV. But though the Cornish crystals in these instances are passive, and covet no particular figure, yet, in a great variety of instances, they are figured either uniformly, or with some accidental differences.

Figured crystals.
Crystals are most generally found in the hexagonal form, and in these three different states ; either pyramidal, as Fig. ix. Plate XIII. their six sides tending to a point ; or columnar, the shaft capped with a pyramid, Fig. x. ib. ; or columnar with a pyramid at each end, as Fig. xi. ib. (page 119) ; making in all eighteen sides or planes.

The sides of the same mass are seldom of an equal breadth and length, some sides being more than three times as wide as others, as in Fig. viii. and xv. ib. neither do they always end in a sharp point ; sometimes the point is shortend and notched, as in Fig. xiii. ib. each plane of the *cuspis* making a distinct angle.

Sometimes the point ends in a sharp edge, as Fig. xii. xiv. xvii.

The pyramidal *cuspis* is not always hexagonal, but sometimes tetragonal, consisting of four equal planes, as Fig. xii. ending in

^m Before page, 104.

edge, underneath which there is a tendency towards forming another equal pyramid; a tendency compleated in Fig. xiv. where the pyramids are nearly equal, on one square base common to both.

The crystal, Fig. xvi. shoots in a triangular form, like a wedge.

Fig. xvii. is tabular, the planes pentagonal, the sides quadrangular.

Fig. xviii. is a shaft on a rhombic base.

Fig. xix. consists of a pentagonal shaft; it is pointed, but very obtusely, at each end, the cuspides being compressed almost into one hexagonal plane. It breaks into rhomboids.

Fig. xx. is the plan of the base of an hexagonal flattish piece of crystal Fig. xxi, whose sides are alternately wide and narrow at its top and bottom. These figured crystals, N°. viii. and from xii. to N°. xx. are all from the Long-close copper-work in Camborn, and being heated gradually (for if violently scorched they will fly) by applying a hot poker, or rather placing them in a crucible over a gentle fire, will throw forth a lambent flame of the rainbow colours, like a native phosphorus.

Fig. xxii. exhibits a polyhedron of crystal.

Fig. xxiii. is the plan of the circular base of two cylindrical columns, Fig. xxiv. of shotten crystal, the only one of that form which I have seen.

Fig. xxv. is the base of the *frustum* of a cone; the exteriour ring of cuspides is bright amber; the next plain opake white; the third radiated, the rays tending from the centre; the next opake white, till you come to the central *nucleus* which is an irregular speck of the yellow copper ore; Fig. xxvi. is the elevation of this *frustum*ⁿ.

Fig. xxvii. exhibits a piece of hexagonal crystal of the finest water, inclosing green sprigs seemingly of mofs. This happens sometimes to crystal, and doubtless to our Cornish crystals as well as others^o. "A piece of crystal (says Dr. Grew, Mus. R. S. Part III. Chap. iv.) in which is immersed a mossy substance of a reddish colour, and there are some crystals have been known naturally to inclose a liquor."

Fig. xxviii. is a cluster of semipellucid crystal shot into reclined cones, which make an angle of near forty degrees with the surface of the stone. The sides of these cones are very curious fret-work of little spires or bristles, many of them sharp as the smallest needle, and pointing nearly in the same direction as the cone on which they rise. The surface of these shoots is of a ferruginous flint-like substance, but the inside more clear and transpa-

ⁿ Mr. Lhuyd has a specimen of like shape, but of a sparry basis, which he calls Fluor triquetrus, N°. xxxiv. Table i. of his Lithophylacium.

^o This specimen was not found in Cornwall, but is introduced to shew that crystals inclose, and therefore have been formed since plants.

rent. It has this farther peculiarity that its shoots tend all one way, whereas, in other crystal lumps, they point differently according to the beds they rise from: the only one of this kind I have yet seen. It came from Trevascus mine, in the parish of Gwynier.

Fig. xxix. is an asterisk of the clearest crystal; its rays hexagonal, swelling or gibbous in the middle; their sides not rectilinear, but ridged near the edges, and somewhat hollow, but not uniformly so, betwixt the ridges. The extremities are entire, ending in one sharp point; and it is very plain that they never had any pyramidal apices: the rays near the base spread horizontally, but the others raise themselves, gradually making a greater angle till the middle and highest make nearly a right angle with the base. I have seen one more of this kind, but not so entire as this curious specimen *.

Fig. xxxiv. a triangular pyramid, the sides consisting of triangles equal to one another, and to the base.

Fig. xxxv. a triangular cuneoid jointed crystal, the base of the one alternately contiguous to the apex of the next adjoining.

These are the principal varieties of crystal which a collection of some years from our Cornish mines has afforded, and I doubt not but new distinctions and different forms, and very likely more elegant specimens, will occur to gentlemen who will industriously collect, compare, and set in order, the crystals of different mines. Of this the curious Mrs. Grace Percival of Pendarves (to whom this collection is indebted in more than one instance) has offered us a fair pattern, by fixing side by side in her Fossillary an infinite number of crystals of various and the clearest waters, in all shapes, single and in clusters, mostly out of mines in her own lands, all out of her neighbourhood. So many rich subjects will well remunerate the attentive inspection of every inquisitive Fossilist at her seat of Pendarves, in the Parish of Camborn, Plate the XIV.

SECT. V. The figures in Plate XIII. are all of the natural size, but the bodies described are not always of the largest kind. The largest hexagonal crystal which I have yet seen found in Cornwall, is ten inches and a half in girt near the base, and seven inches and three eighths high. It weighs three pounds and half an ounce. From this size we have these crystals of all dimensions down to that of a small pin.

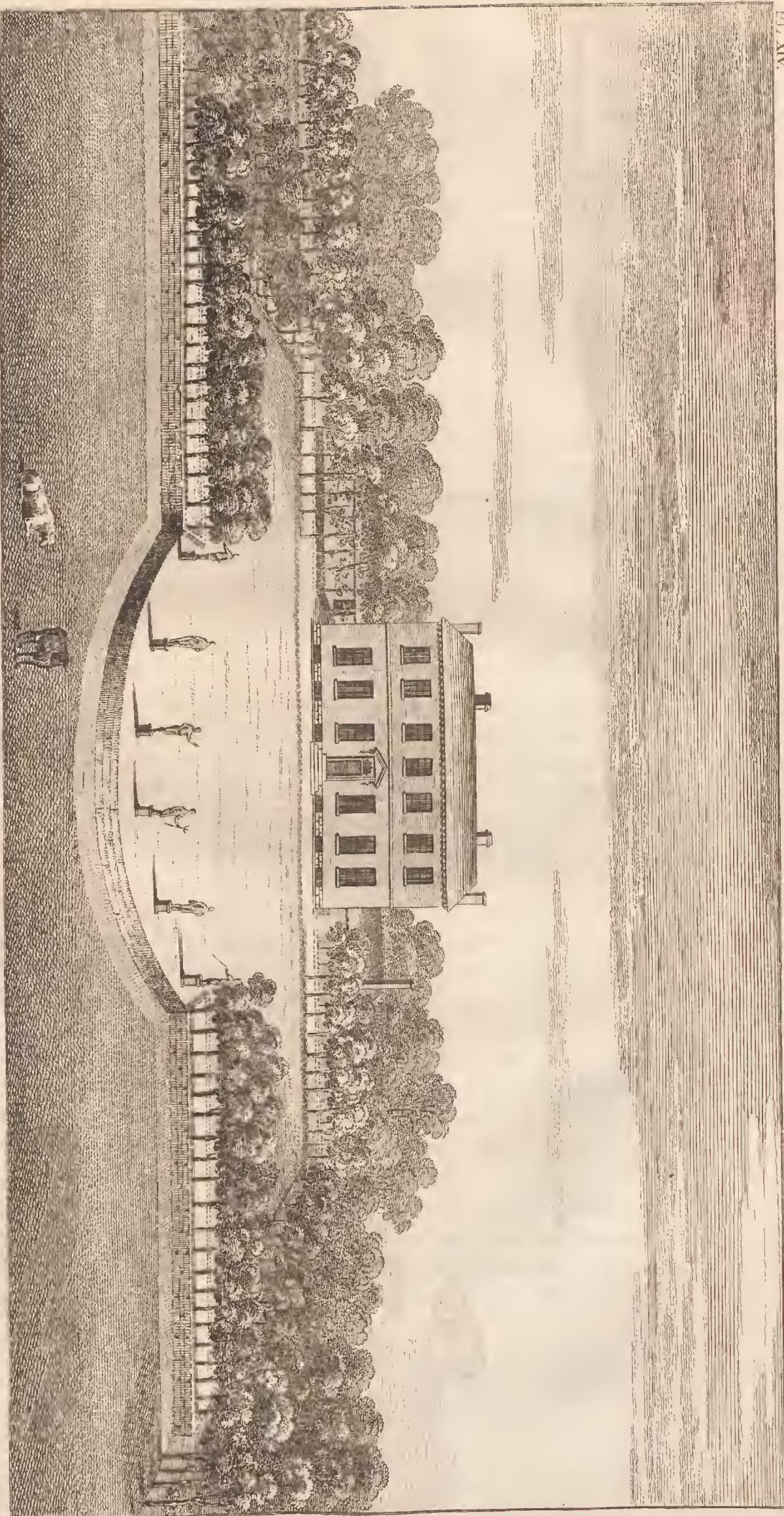
SECT. VI. They are sometimes of a fine clear water, and are therefore commonly called Cornish diamonds, and of all our bastard diamonds in this nation are esteemed the best¹; but they are not all colourless,

* The intermediate numbers are explained in the following pages.

¹ "Of our bastard diamonds here in England

the Cornish are the best, much better than those on St. Vincent's rock near Bristol." Grew's Mus. R. S. Part III. Chap. iv.

some



To Samuel Percival Esq; this Western View of
engraved at his expense is most
gratefully inscribed by
Wm Borlase



some are yellow, brown, cloudy, opake white, green, purple, black, some freckled with little specks of various colours and magnitudes, every crystal being either pure and pellucid, or receiving its tinge from the mineral juices and earths adjacent. These stones, it is observable, are generally more clear and transparent at the point than at the root. I have had two samples of crystalline *cuspides* entirely black, and have seen no more, they being very rare. This sort is taken notice of by Linnæus Syst. Nat. page 167, and is, I think, his *Nitrum quartzosum nigrum*, or Morion¹.

The more clear they are, the heavier; of which the reason seems to be, that in clear ones there is more stone in any given quantity, than in opake ones, which latter consisting of earthy and mineral impurities mixed with the stony, must therefore under any equal surface include less stone than the purer ones, and this observation is confirmed by the superior weight of the true diamond to that of other stones. The weight of our Cornish diamonds to water, I find at a medium, as ten and a half is to four.

The same reason that makes the pure more heavy than those which are otherwise, makes them also harder; the more stony similar matter there is, the closer is the connexion of parts; whereas the cohesion is greatly weakened, and the body becomes more friable by means of the earthy parts which intrude themselves among the stony; the clearer therefore our Cornish crystals are, the better their points will cut glas (though not so free, or so deep as the true diamonds) and the better they will bear engraving for seals.

The texture of these figur'd crystals is various; some are of an uniform texture, of one colour and consistence throughout: this was the case of Fig. v. vi. xxiv. and many others here exhibited. Some spring as from a center, or one common line, as Fig. v. vi. vii. xxxiii; some have hexagonal sheaths described one within another, as Fig. xxx. a very remarkable structure, and not easily accounted for; some learned men imagine that they are different incrustations, applied successively at different times, one without the other, and such indeed at first sight they seem to be, but if we recur to the original formation of these bodies (as in order to discover truth we must) it will be very difficult, not to say impossible, for us to conceive any position or direction in which the middlemost shaft could lie, so as that three incrustations of such an equal thickness should form round it, neither will the laws of gravitation and

¹ Vide Morion.

projection

projection permit that any juice should crystallize in such thin, equal, and continued plates as form these sheaths: it is an opinion attended with much fewer difficulties to think that they all hardened nearly at one time, and that the whole shoot when uniform was produc'd at one effort, but where the structure varies, by some succedaneous, direct, or undulating efforts in point of time following close upon one another; that in the latter case the juices of which the mass consisted, gave way to the efforts in proportion as their different mixtures made them more or less susceptible of the motion impressed, the most agile and purest stone flying off to the greatest distance from the center, and the coarsest and most opake remaining nearest to the center; and to this latter opinion I the more willingly adhere, because (as I hinted before) these stones are generally more clear at the point than at the root, and because in many orbicular lumps of crystal, particularly Fig. vii. I find all the middle of the lump (*a, b, c,*) opake, terrene, and cloudy, the sheath next the middle faint and dusky white, the next sheath faint purple; the third a brighter white than the first, the next a wider seam of purple, but its tinge fainter; the fifth a more distinct white, the next a transparent list of crystal in which the purple tinge was scarce discernable; the last and outmost of all, the purest crystal. In this specimen it is very observable that the white and the purple are alternately fixed in parallel angular fillets, the crystal gradually forsakes the purple tinge as it advances to the extremity, and the white increases its purity in three degrees till it ends in a fourth of the clearest crystal, confirming (as I should think) what has been hinted before, that the purer the crystal, the farther it proceeds from the center, whilst the more impure and sluggish parts of the mass rest stubborn and unmoved in the center of all. The texture of Fig. xxv. establishes the same truth; at the first effort, the purest crystal fled off and coated the circumference with hexagonal cuspides; a fainter effort succeeded, whereby the purer parts of the remaining crystal were protruded so from the center as to form a circle of subdiaphanous rays in the opake white.

SECT. X. The variety of figures in which these bodies are found has been
 Their figure already mentioned, and the cause to which these figures are owing
 must now be taken some notice of. That these stones have been
 in a fluid state, and thence passed into their present solidity, must
 evidently appear, by observing, that the four first figures, Plate XIII.
 page 119, are of the stalactical kind; that Fig. v, vi, vii, xxiii,
 xxix, xxxii, plainly indicate their having shot forth as from a
 center, protruding themselves every way till they terminate in a
 point;

point; that Fig. xxvii is of the clearest crystal inclosing something of the moss kind, which could never happen but when the crystal was in a fluid state. Fig. xxxi is a groupe of hexagonal crystals pointed at each end, and immersed in the substance of one another, in such a manner as could not have happened but when some or all of them were in a state of fluidity, the hardest making their way into the softest, and the softest closely cohering to the hardest, so as that they both consolidated into one lump. All these facts are plain from the inspection of the bodies before us, and there is not the least occasion to have recourse (as some moderns have done) to any operose chemical analysis to prove, that crystal has been fluid, and therefore may be so again. Another consequence is also plain, *viz.* that, during this state of fluidity, they received the several figures in which we now find them; but to what cause this variety of figures is owing, must be the next enquiry, and is very difficult to be satisfied. That stone, *quatenus* stone, has not the faculty of producing these configurations, is a truth sufficiently confirmed, one would think, from the vast *strata* of quarries, cliffs, and fissures of stone in which there is no regular rectilinear form: the shootings of stone into figure are small in comparison, few, and rare, owing to accident and mixture, not the essential products of the *strata*. All small quantities of lapideous matter would probably form themselves by the mutual attraction of similar parts, and the equal pressure of surrounding fluids into globular masses, as water, oil, quicksilver, and liquid bodies do, were it not for something which intermixes with the stony matter, and prevents this simple figure from taking place. The crystal which appears in the stalactical form, has nothing in it which tends to configuration, more than any common shapeless marble, spar, or killas, and may convince us that meer crystal covets no particular figure. Crystal in this state wants that active principle which throws the same stone at other times into a great variety of shapes; what that principle is, the learned do not agree; but clear it is, that it is something adventitious and different from crystal. It has been imagined, that the angularly-figured crystals owe their shape to the different metals which they encounter during their fluidity; but this is seldom the case *, for crystals, which are of four, five, or, what is still more common six angles, are oftentimes extreamly clear, and have no appearance of any metal in them, neither do they yield any metal upon trial by fire that ever I could learn. "Pure crystal, and without mixture of other matter, says Dr. Woodward; concretes ever into an hexagonal figure, pyramidal or columnar, terminating in an apex;" but we

* See page 127.

[†] Cat. vol. I. page 220.

have as pure crystals of the tabular kind; we have quadrangular columns, and triangular pyramids, as pure, to all appearance, as any of the hexagonal kind whatsoever; the cause therefore of the hexagonal figure must be somewhat distinct from pure crystal, since we find that pure crystal can subsist without it, and is found as transparent, hard, and immoveable to acids in other figures as in that. It must be also distinct from the cause of other figures; for the same principle which forms bodies into an hexagonal mass, cannot be that which in other places give the trigonal or rhomboidal shape to bodies of like substance. It is true, crystals are oftener found hexagonal than in any other figure; but this can prove only, that the cause of this figure is more abundant than that which occasions the other figures; it will not prove, that it is inseparable from pure crystal. Salt is the most active principle of the fossil kingdom, every where dispersed, ever busy, when fluid and at liberty, in producing multangular figures, according to the several powers with which nature has invested particular salts^{*}; and it must be observed, that there is hardly any figure in the crystalline class but may be found in the analysis of some salt or other. Thus, for instance, in nitre (a salt dispersed in earth and stone, in air and water, in plant and animal,) we find the exact representations of hexagonal crystals in their different states[†], now with one pyramidal apex, as Plate XIII. Fig. x. now with two, as Fig. xi. sometimes with equal correspondent sides, as Fig. x. sometimes with unequal, as Fig. viii. "some cut sloping at the ends down to a sharp edge, in the manner of a chissel," (ib. page 62) as Fig. xix. but always hexangular. In *sal gemmæ*, and sea-salt, we find the quadrangular pyramid, with the truncated ends, (ib. page 57) as Fig. xii. In the crystals of alum we have the polygon, Fig. xxii. as well as in the salts of lavender and thistle, (ib. page 180). Among the crystals of distilled verdigrease, (N°. vii. ib. Plate II. page 96) we have the columnar rhomboidal shoot, Fig. xviii. In the salts of tin (page 128, ib.) we have the two pyramids applied base to base, as Fig. xiv. In Cheltenham salts (ib. page 154, Plate V.) we have the exact asterisk, as Fig. xxix. The salt of Camomel has Fig. xx. (ib. page 166), and the parallel lists of Fig. xxx. may be seen there and in the salts of fennel, (page 172), and in the salt of thistle, (page ib. 180.) The salt of the Jesuit's bark is full of rhomboides. In the *sal gemmæ* (letter e, ib. pa. 74) is that lump of pyramidal cuneoids placed laterally as in the crystal, Fig. xxxv. The pentagonal tabulated crystal is found also in the salts of camo-

* This has made some Naturalists advance that omnis crystallizatio est a sale. "Salia crystallizationis omnis unica causa." Linnæus Syst. Nat.

page 224.

[†] See employment for the microscope, by Henry Baker, Esq; F. R. S. vol. II. page 65.

mel, (ib. page 166.) The zig-zag angular fillets of Fig. vii. are found in Cheltenham salts, (page 154, ib.) In the salt of antimony we find the conick spires of Fig. xxviii. and in general it may be affirmed, that there is scarce a figure among the crystals but may be traced among the salts analyzed; here therefore I would observe, that all the influence which metals have upon the shape of crystals, is probably owing to the salts of those metals; for it is observable in the salts procured from tin (as exhibited by Mr. Baker, ib. Plate IV. page 128) that they are exactly of the same polygonal shape as the real stony crystals, including this metal which in Cornwall we call Tin-grains^a. Again: Let it not pass unnoticed, that crystals in several specimens have all the indications necessary to shew that they were protruded, sometimes from one common intermediate line, as Fig. v. vi. sometimes from a point, like rays from a center, as Fig. xxiii. xxv. xxix. and xxxiii. herein also imitating the agility of crystallizing salts, which shoot and extend their rays visibly in like manner; and forasmuch as here are proofs of the same procedure of figured bodies from an unfigured mass, and of the same figures produced by that process, it seems but reasonable to conclude, notwithstanding the objections of some moderns, that the figures of crystals are owing to the adventitious salts which prevail in the crystalline matter.

As crystals, especially those of the hexagonal kind, are frequently found in clusters with one end fixed in a bed of coarser crystal than the shoots, and that bed broke off from a larger mass of still coarser materials, I went not many years since into a mine^b on purpose to observe these crystal productions in their natural site.

The cavity to which we were introduced, was not much larger than a common baker's oven, and much of that figure, about five feet high from the floor. The roof was the most surprizing piece of fret-work imaginable, consisting of hexagonal crystals pointing forth in every direction very plentifully^c of several sizes, sometimes projecting in groupes and clusters from large protuberances in the cieling, sometimes single, now crossing each other, now standing by each other with parallel sides; the finest were those which had innumerable little diamonds or sparks of the clearest water besprinkled upon their sides: I observed that their pointing was usually according and nearly perpendicular to the planes from which they proceeded; from which I conclude, that as the plane, the shape, and turn of the

^a See Plate XX. of the figured-tins.

^b Pillion-erth, in the parish of St. Just.

^c In Norway hexagonal crystals, "are called Mountain Drops, and known from experience (says Bishop Pontoppidan, page Eng. 170) to be

generated in a chalky porous stone, in shape like a drop-stone;" but if this was their original, such bodies could only point to the center of the earth, as all stalactites must by gravitation of their parts; but the reverse is true.

lapidific

lapidific matter (when drained of superfluous moisture, and disposed to shoot) happens to be, so will the tendency of the shoots, both column and point, be: in all concave beds, for instance, the points will converge; in all convex ones, they will turn the contrary way: if the concave part, for example, of the ammonites, Fig. XXXII.^y be set with crystals, their points will tend inwards towards the centre, being thereto compelled by the regular contour of the *cornu-ammonis*; but if the crystal rises from a convex bed, or orbicular lump, then will the columns spring as from one common centre, and point forth their *radii*, as in Fig. XXXIII. Pl. XIII. p. 119. If there be a thin plate of crystal, equally exposed to the influence of heat or cold on each side, with equal room and force to shoot, it will throw forth its points on each surface, and the line, from which the fibres began to spring, shall be exactly in the middle of such plate of crystal, as Fig. v. Fig. vi, ib, is also easily to be accounted for on the same principles: it is the section of an oval lump of crystal, equally impregnated with salt; it must therefore shoot as from a line or commissure in the middle; for the contiguous columns, being protruded on every side with equal force, must be of equal length; if the lump had been globular, these rude columns would have shot as from a center, as in Fig. xxiii. and xxv. ib. the fibres do. Hence I conclude, that the direction of columnar crystals is nearly rectangular to the plane of the bed from which they issue, and that all the seeming confusion in the pointings of these bodies in the mine above-mentioned was owing to the great variety of surfaces and angles into which that large body of crystal was hardening when these hexagonal crystals shot from its extremities.

C H A P. XII.

Of Semimetals found in Cornwall.

FR OM stones of ornament and curiosity come we next to the products of the mines and stones of profit, few countries, according to the judgment of foreigners, exceeding this county in the variety and plenty of minerals^z: but we have rather the possession than the enjoyment of this treasure; for though this multitude and variety appears every where in those parts most subject to mines (I mean from St. Austel westwards), yet few of our people

^y From Mr. Allen's quarries at Bath, none of that sort being yet discovered in Cornwall.

^z Beecherus refert de Cornubia in dedicatione

alphabeti sui mineralis se credere nullum terrarum locum reperiri qui minerarum multitudine et varietate antecellat.

(engrossed)

(engrossed as they are by tin and copper) are either delighted with or even sensible of the one, or at all the richer for the other.

Of bismuth, speltre, zink, naptha, antimony, *lapis calaminaris*, and molybdæna, I have received specimens from several parts of Cornwall: they are just enough to whet the appetite of the curious, but hitherto not enough to awake the industry or fix the attention of the owners.

We call bismuth tin-glaſs, and several bits at several times, pure Bismuth. as if in a metallic state, I have received from the parish of St. Just, but, put all together, they will scarce make a pound weight: it is more plenty, though more dispersed, in Mr. Beauchamp's cobalt mine, in the parish of Gwenap.

Speltre ore I have had from a mine near St. Columb, and Dr. Woodward, Cat. vol. II. page 83, mentions some from St. Merwin near Padstow. One semimetallic specimen, which I have from Camborn, of a brown, cinereous colour, very close-grained, ponderous, and of uniform structure, has been taken for zink^a.

Of Naptha I have seen but one specimen, which came from Tolgaric work, in the parish of Camborn.

In the parish of Endelian there are several veins of antimony SECT. II.
mixed with small spots of copper and some lead, there called Ros- Antimony.
carrock's^b (as Grew says, Musæum R. S. page 334): these veins run sometimes north and south, but oftener east and west: the north and south veins are the biggest; and when the east and west veins join, or cross the former, they commonly make a bunch of ore from one foot to two feet wide, all of solid antimony. Some antimony is now raised in the lands of the Reverend Mr. Hearle, in St. Minver, a parish adjoining to the former. Antimony has also been found in St. Austel parish, in St. Stephen's at Howton, and in a place called by Dr. Woodward (Cat. vol. I. page 184) Barbary-work; in St. Kew parish also, as the same author (Cat. vol. II. p. 20) informs us, and, I doubt not, is thrown away as useleſs in a greater number of places; but there are no workings on this mineral in the county at present, considerable enough to be more particularly mentioned. It need only be observed, that antimony is reckoned to be of an intermediate nature betwixt gold and silver, and by the texture, and weight of its ore, so likely to contain metal, that the late famous Dr. Boerhave tried for a whole year to extract from it a real metal, but without success^c.

^a By Mr. Ornskold, a learned Swede.

^b From a Manor of ancient note there, I suppose, more abounding in antimony than the rest

of that neighbourhood. See the Map annexed.

^c Theor. Chem. page 13.

SECT. III. Manganese, a ferruginous mineral, used to attemper and bring Magnanese. glass to its proper lustre^a, has been lately discovered near Tregoff's moor, in the parish of St. Columb; the load is twenty feet wide, and so near the surface that one ton may be raised for one shilling and six-pence; there is some iron in it, and a great deal of the coarse *lapis haematites*: but there must be something much more valuable than iron; for, in the year 1754, a ton of this ore was sent to Liverpool, and thence to Boslam, forty miles distant, and was there sold for five pounds eight shillings and six-pence^b: but though many tons have been raised, the adventurers meet with very little demand for it; one, among many proofs of the want of intercourse and correspondence betwixt Cornwall and the proper markets for minerals. Dr. Woodward, Cat. vol. I. page 30, mentions a considerable quantity of manganese, discovered about three miles from Penzance.

In the year 1750, in a mine near the town of Penryn, were discovered several bunches of load-stone; having tried and armed some pieces of them, I found their magnetism not strong, and the present perfection of artificial magnets renders the labour of searching further after natural ones entirely needless.

SECT. IV. I have one specimen only of molybdæna; the stone to which it Molybdæna, adheres is very like the more gritty kind of *lapis calaminaris*, which or the pencil lead. sometimes contains lead: some small gravels of this will mark paper as free as the molybdæna from Cumberland; the gravels are about a third of an inch in bigness. They came from a work in Camborn, called Huelcrafty, whereabouts very likely there may be more of this very scarce fossil to be found.

SECT. V. In the year 1754 the society at London, for encouraging arts Cobalt. and useful discoveries, thought proper to offer a præmium of thirty pounds for the best cobalt discovered in England; and a discovery of this kind being made in the lands of Francis Beauchamp, Esq; in Gwenap, the mineral found was sent to London in December 1754, and honoured accordingly with the præmium; and as the different arsenicks, as well as zaffer and smalt, (of great use for staining glass blue, and painting in oil-colours) are procured from Cobalt, and hitherto imported at a great price from foreign countries, it is wished that this discovery may be compleated, and, by keeping our money at home, be of use to the nation in general, as well as profit to Cornwall in particular. At present the Cornish

^a Cramer's Theor. page 201.

^b Iron is delivered at the iron-works from the

forest of Dean usually at the price of twelve shillings and six-pence per ton.

are entirely to seek for the method of assaying, and even distinguishing critically the cobalt from its various mixtures in the mine; and till the cobalt is carefully selected, it will probably be of little value. In the same load there is a good deal of Bismuth, not only where the cobalt is, but so prevailing in other parts of the mine, that it may as justly be called a mine of bismuth as of cobalt^g; and bismuth being of great use for hardening and perfecting pewter, &c. and many thousand pounds sent out of the kingdom yearly for it, this mine will, it is hoped, prove as valuable for its bismuth as its cobalt, under proper direction.

Native rock-salt, or salt from springs, or pit-coal, I have never yet heard of found in Cornwall: these seem to be the portion of other parts of England; some countries are favoured with one thing under the soil, some with another, and Cornwall has little reason to complain of her allotment.

Dr. Woodward^h mentions a sulphur-ore from Redruth, and native sulphur in a mass of antimony from a mine in St. Kew parishⁱ. This is the yellow matter that covers and interlaces the veins of antimony in the parish of Endelian: at the mine it is unctuous, and burns freely with a blue flame^j.

But of all our fossils, which are mineral only, (as far as is yet SECT. VI: discovered) and not metallic, that which we call Mundic offers itself Of Mundic, in greatest plenty, every where almost intermixed with tin, lead, and copper, but sometimes found making a lode or vein by itself without any metal near it.

This is sometimes called a Pyrites, but better known among Naturalists by the name of Marcasite^k, a name proper enough for any fossil, which, for ought we know at present, has only the appearance, mark, or outward testimonies of metal, such as weight and colour, but oftentimes used as well to express a fossil any-ways remarkable for the regular figuration of parts, or glitter of its surface. The Cornish name is Mundic, from the cleanly shining appearance both of its surface and structure, and to this name I shall confine myself.

This semimetal is variously coloured on the outside with blue, SECT. VII. green, purple, gold, silver, brass, and copper-colours; but, exa- Colour, and mining it at the fracture, I find only three distinct colourings, which texture.

^g The bismuth was quite thrown away till the learned and sagacious Dr. J. Albert Schlosser, F. R. S. came to view it September 8, 1755, who extracted the cobalt tint for glass and smalt, and at the same time separated and preserved the Bismuth.

^h Vol. II. Cat. page 17.

ⁱ Ib. page 20, g, 3.

^j Ib. g, 12.

^k Italicè Marcasita a verbo marcere, to stamp or mark any thing.

I distinguish, first, into the silver or plate mundic; secondly, the brass or *pyrites aureus* of Grew; and, thirdly, the brown colour: the other colours are no more than a thin film or sediment, which water, either from its own impregnation, or the nature of the fossil it rests upon, deposites upon the surface.

The texture of mundic is either fibrous and radiated as in pyrite nodules, or flaky and tabulated, or wavy and of crooked fibres. It is found sometimes solid in large glebes and plates, sometimes in grains and detached masses from two inches diameter and under, or, lastly, in micaceous granules, either loose as sand, or fixed in incrustations.

SECT VIII. There are very few copper lodes, if any, but what have this semimetal (which may be called a kind of wild, mock-copper) attending as it were upon them; and therefore, in searching for copper, it is reckoned a great encouragement to meet with mundic.

Its combinations with copper. The mundic does not intimately incorporate itself with the ore of copper; for copper, in its mineral state being usually of close consistence, repels the mundic, which is therefore easily separated from it either by breaking off that which is fixed with hammers, or by washing away the small in water, or by evaporation in the furnace.

SECT. IX. But mundic unites more closely with our tin-ores, especially when found in a lax sandy state, oftentimes as moist and soft as mud: in this case the mundic mixes intimately with the tin; and, being specifically heavier than the tin-ore, will not separate from the same by washing as other impurities will, but impoverishes the tin, and makes the product so brittle, that the tin is worth little or nothing. To destroy this connexion therefore, we have recourse to the following method: When the tin-ore has been stamped, that is bruised sufficiently and pulverized by the mill, we put it into a furnace erected purposely for roasting it, called a Burning-house. Here the fire must be managed and kept very moderate, and the tin-ore raked and stirred well every quarter of an hour, otherwise the tin will fuse (especially in the hottest part of the furnace), and then it must undergo another expensive trituration in the stamping-mill. The gentle fire evaporates the arsenical and sulphurous parts of the mundic sooner or later, according to the quantity it has to work upon. 500 pounds weight of black-tin, strongly impregnated with mundic, will take twelve hours roasting to evaporate the mundic, but the moderately infected ore will throw off the mundic in eight hours; so that nothing but the earthy and lighter parts remaining

remaining, those are easily washed off, and the tin-ore remains behind in such purity, that the melters will give twelve parts of white melted tin for twenty parts of such tin-ore, and this is as good a price as the generality of tin-ore brings.

Our waters are infected by mundic more or less, according to SECT. X. the quantity which they pass through, and the disposition of the mundic either to retain or communicate the noxious principles of which it consists. Arsenick, sulphur, vitriol, and mercury are the constituents of mundic, yet these seemingly so pernicious ingredients are so bridled and detained by their mutual action and reaction, and by mixing with other minerals, that the water is not poisonous (generally speaking) even in the mine where it proceeds directly from the body of the mundic lode ; nay, in the mine, as I am well assured, this water will sometimes cure wounds, bruises, and sores, if the habit of the body be not very corrupt. However, though the mundic in general is so retentive of its arsenick that it will not yield it to water, and that nothing but fire can certainly separate it, yet it is not always so innocent ; for at times it yields that or some other poison so copiously, that I have known a tinner of the parish of Ludgvan¹, who, by washing his wounded leg in a very strong mundic-water in Ludgvan-lez mine, brought on such a gangrene that it soon killed him. In the same work it was remarked, that the smell of the mundic was about that time so strong, that it altered the most sanguine complexion of the labourers into pale and languid, and the effluvia of their cloaths were quite loathsome ; but in some parts of this mine the water was more tainted than it was in others, and the damps and steams much more offensive. At Crowliss, a village of Ludgvan, in the year 1739, a flock of geese belonging to James George, taylor, went into the river as usual, and, drinking heartily of the water, upon their return to the bank nine of them lay down immediately, and died ; but commonly this brook, though of a red turbid colour, by reason of the mines and stamping-mills through which it makes its way, is not poisonous, for many horses, as they pass daily, drink of it, and receive no harm. This mundic-water however is a great enemy to the finny breed, being either poisonous at times, or so loaded with the dirty *pabula* of metals, that the young spawn of fish cannot live in it ; for it is observable, that in some brooks, where, about fifty years since, there was plenty of fine trout (particularly the river Conar in Gwythien) since the copper-mines have thrown into our streams this mundic-water, there is not a fish to be seen. This mundic-water corrodes iron, by reason

Its commun-
nications
with water,
earth, and
fire, and the
ill effects.

¹ Edmund Thomas.

of the vitriol with which it is impregnated, very soon ; so that, in our hydraulic engines, the pistons of the pumps in copper-mines must be made of brass, or they are eaten away and become useless in a little time.

SECT. XI. Mundic mixed with earth will destroy all vegetation, its salts with earth. being too acrimonious and fiery to enter the finer vessels of plants without rending and utterly spoiling them ; for which reason the mundic, pulverized at the stamping-mill, is carried off to mix with the sea-gravel and clay, and effectually prevents all grass and weed from growing in gravel-walks.

SECT. XII. Fire has a much worse effect upon mundic than the other elements, and throws it into its most fatal state ; for when it has been somewhat burnt, and the sulphur which sheathed the poisonous *spicula* of arsenick is dispersed, the arsenick acts without restraint. In the management of the furnace, called the Burning-house, great caution must be used : the arsenick, which flies off from the ore, has several rests and pauses ; it fixes upon the stem and head of the iron rake which stirs the tin, in bunches of white-yellow dust ; and here it is reckoned most poisonous, as being least mixed ; but it is also strongly poisonous from the bottom of the flue of the chimney upwards, where, although it is a mixture of mundic, sulphur, and foot of pit-coal as well as arsenick, it is yet so fatal, that a person of an adjoining parish to Ludgvan, rashly looking down, and prying into the chimney of one of these Burning-houses, was seized instantly in so violent a manner, that, notwithstanding all proper assistance, he soon died. The workmen are oftentimes obliged to sweep out these furnaces and clear the chimney, a service of no little danger ; it is usual therefore to put a cloth before their mouth and nose when they are upon this duty ; but Elijah Bond, a youth of the parish of Ludgvan, sweeping out what they call the oven, (the place where the tin-ore lies roasting) at Rosingrows Burning-house, January 25, 1750, without the necessary precautions, was taken ill immediately, and, though he had the usual remedy of oil given him, he died that evening.

SECT. XIII. The smoke of burnt-mundic when it leaves the chimney being with smoke. more dispersed, is not soon, but as surely fatal to all tender herbs and plants, and bees of the adjacent neighbourhood, as it lights upon them ; and the fire-men, who attend this process, greatly impair their constitutions, if they make it their sole and constant employment.

The three sorts of mundic above-mentioned, Section vii. differ SECT. XIV. not only in colour, but in the more decisive and less variable pro- Weight of perty, weight. mundic.

{ Plate-mundic striated weighed to water (Au-	{ } 6-- ₂₉ ²¹	} to 1.
gulf 19 1755) as - - - - -		
{ Plate-mundic granulated - - - - -	7-- ₁₀ ⁶	} to 1.
{ Bræs-coloured cubical mundic - - - - -	4-- ₂₀ ¹⁹	
{ D°. - - - granulated - - - - -	5-- ₂₈ ⁸	} to 1.
{ Brown-mundic - - - - -	4-- ₁₇ ⁷	
Second sample of D°. - - - - -	4-- ₂₈ ⁴	to 1.

The plate-mundic therefore is in weight to water near as seven to one; the bræs-coloured is not so heavy, being but as five to one; and the brown is still lighter, being but as 4--¹₃ to one.

Notwithstanding that the specifical weight of mundic exceeds SECT. XV. that of most fossils, and that it has, to all outward appearance of its produce. colour and texture, such a near resemblance to bræs, it is so pregnant with sulphur and arsenick, that, though a fierce fire will melt it, yet will it fly into powder under the hammer, and by no flux hitherto discovered can it be reduced into a metal. Notwithstanding the failure of all former experiments, the appearance promised so much, that the late learned Dr. Boerhave sent to me by a friend ^m for all the sorts of it which could be procured, in strong confidence that he should be able to find out a method of making it turn to account. All the sorts were accordingly furthered to him; but the death of that great chemist soon after, deprived us of those assiduous and skilful experiments, which, under his eye, might have been blessed with discoveries of great importance.

Mundic will yield in evaporation its quantity of sulphur and arsenick; but these are so much easier, and at a less expence, to be procured other ways, that it is not worth while to endeavour after them by burning mundic. Mr. Boyle ⁿ procured by distillation four ounces of good brimstone from three pounds of these stones; and says, that they contain particles of copper and iron; that mercury may be thence procured; and that a skilful person may possibly make a profitable use of marcasites, either by fixing the volatile gold or silver contained therein, or by graduating silver by their means; and Kentmannus observes, that some marcasites contain silver, others gold, and others both, ibid. The white or plate-mundic far exceeds the other sorts in weight; and, if I am not

^m Dr. J. Andrew of Exeter, then at Leyden.

ⁿ Boerh. Theor. of Chemistry, English.

misinformed^o, yields not only arsenick and sulphur, but a powder very near, if not equal to, and the same as ultramarine.

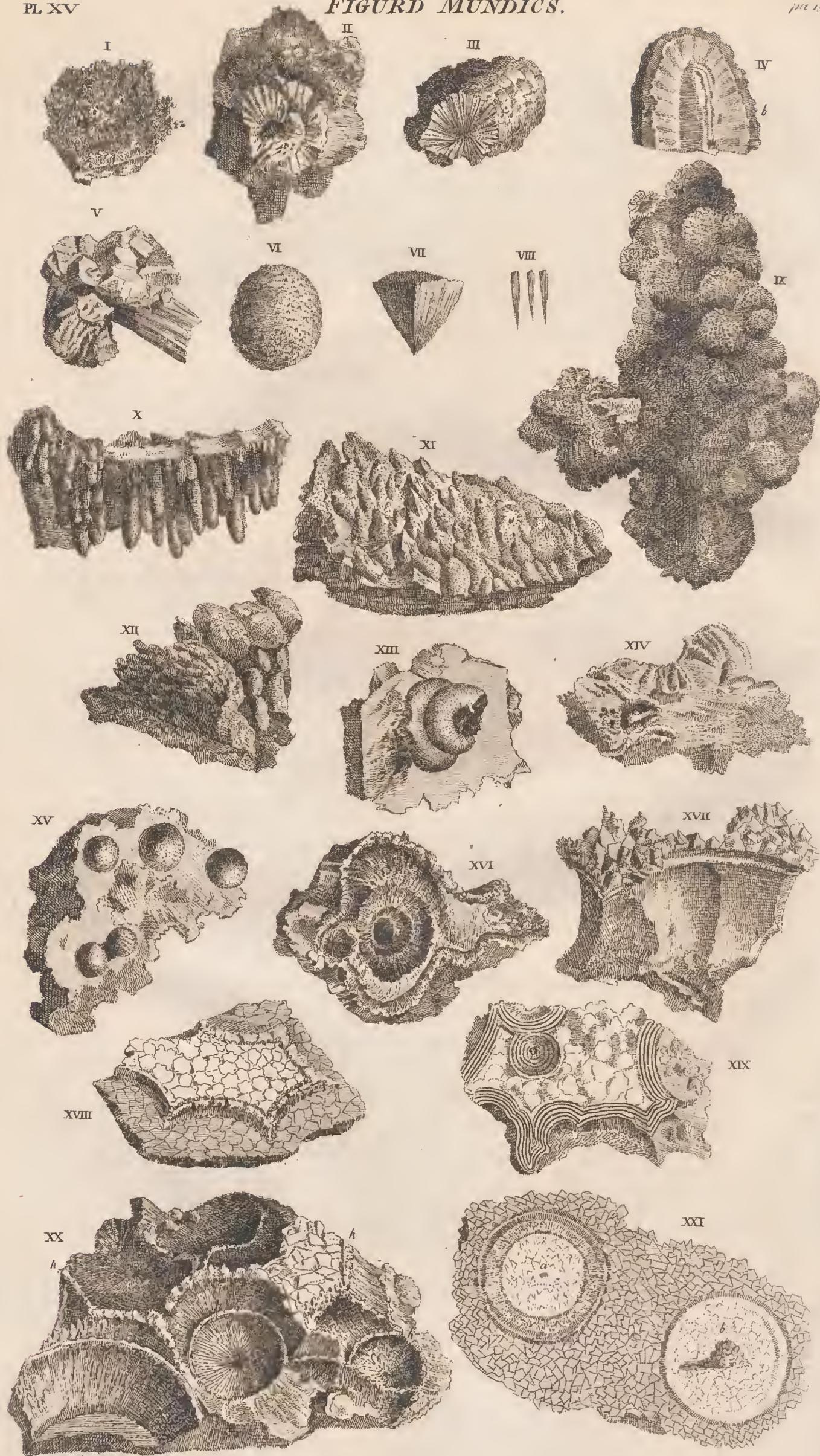
In the year 1750 I had a sample of the same plate-mundic, abundantly mixed with speltre, from a work in Gwynier parish. It may therefore be well worth while to enquire farther into this mundic, whether ultramarine may be procured from it in any answerable quantity; and, secondly, whether it may serve the purposes, or increase the powers and quantity of speltre; and, in continual searching, other uses, not now foreseen, may probably occur.

SECT. XVI.

Mundic concretions formed at different times, and are still forming.

Crystals and mundics are frequently found in the same beds, and by the inspection of several specimens, we may rest assured, that some mundics were indurated before the crystals, as appears by the plain impression made in the crystals which adhered to them, and from which we may easily separate them; and other specimens will as readily convince us that they were indurated since the crystals, being formed into cappings and incrustations upon the cuspides of the Cornish crystals, from which they have visibly received the hexagonal impression. Further: There is great reason to believe, that mundics are perpetually forming (as is probably the case of all ores) new combinations where they have proper room, liberty, *nidus*, and subjects to fix upon; for in the fragment of a Cornish crystal brought me, in the year 1752, from a mine which had layn idle about thirty years, I perceived an incrustation of granulated besprinkled mundic beginning to coat the crystal in the fracture: now, there is all reason to believe, that this crystal was broke in the columnar part when the mine was worked last, which is betwixt thirty and forty years ago, so that this mundic incrustation must have fixed itself on this fracture since that term. The following accident confirmed the supposition: Having laid by some mundics in a drawer, and coming about two years after to examine them, I found several glebes of yellow-mundic, which were separated when I put them by, sticking close together; one glebe had picked up a bit of blue vitriol, a grain of lead, a grain of copper, and a grain of crystal; and the yellow-mundic had also shot round about, and closely embraced a piece of the plate-mundic: hence we see that the mineral principles are always active, and forming new concretions; and likely this activity is in proportion to the mineral and metallic salts which the fossil contains: here the yellow-mundic was most active, as consisting of more salt than the plate-mundic; but the brown-mundic has more salt still than the yellow, and will divide and fall in pieces commonly in any moist place, and shoot

^o By a letter from Dr. J. Andrew from Leyden, 1738.



forth its vitriolic salts into white wool-like threads: this is therefore the more apt to dissolve former, and to frame new associations.

Some learned men have thought that the variety of fossils is greater than that of plants; Mr. Ray doubts it^p, and the estimate cannot be made with precision till the subterraneous parts of nature are as well known as the superficial. Many fossils have been discovered since Mr. Ray*; in the year 1716, Doctor Woodward reckoned three thousand sorts, and distinct species are making their appearance every day: however, it must be allowed, that it is very consistent with the goodness and wisdom of Providence that the surface of the earth should be cloathed in a gayer dress, and engage the attention of man with a greater variety of colours, shape, and beauty, than those parts which lie underneath, and come more rarely under the inspection of mankind. But nature, where-ever we pursue her, has not left herself without testimonies of her regard for colour, shape, and elegance; this will appear from the description of the figured fossils which follow, but in none more conspicuously than in the mundics, in which figure, lustre, gilding, carving, regularity, and finery, are as it were thrown into the scale to make amends for its little intrinsic value. As this mineral therefore has been hitherto very sparingly traced, I have given two plates of the several varieties which have reached my notice in this county, in a search of twenty years, all in their natural size.

Fig. I. Blistered mundic of the smallest grain, a kind of stalagmites, or exudation. PLATE XV.

II. Blistered D°. of high relieveo, the blisters covered with spangles, smooth, hexagonal, brass-coloured, the fibres at α shooting as from a center, and forming a semicircular opening like the arch of a bridge.

III. Surface squamous, wrought like the scales of a fish; its texture radiated.

IV. Part of an oval incrustation of brass-coloured mundic, *b*, *b*, within which an elliptical crystal pebble, shewing at the section, by three lifts, the tremulous efforts of the crystal when it shot.

V. Three lumps of hexagonal, large-spangled mundic, capping a piece of crystal.

VI. A globe or ball of sparkling, brass-coloured mundic.

VII. Part of a round nodulous pyrites; its texture radiated from a central point, by the moisture of the air divided, and falling easily asunder into taper pegs, as Fig. VIII.

Circular protuberant figured mundics.

^p Of the Creation, page 21. * Viz. 1691.

Fig. ix. A bottrueid, or high-blistered, sparkling mundic-incrustation on the clearest crystal, the colour of the most polished brass.

x. Stillatitious mundic, sparkling, yellow, pendant, from the Pool copper-work in Illogan⁴.

xi. The tubercles or blisters oval, inclined in parallel direction; on the summit they have *mammillæ* or nipples; the surface sprinkled with a gold-coloured and purple powder; the texture brown flaky-mundic, very uncommon. Likely stillatitious.

xii. Oval blisters of the brown-mundic, clustered like a pineapple, sprinkled with gold powder as the former, on a bed of copper.

xiii. Brass-coloured mundic of a velvet gloss, wreathed in the shape of a turbinated shell, from the mould of which it seems to have borrowed its figure, and may therefore be reckoned an extraneous fossil: from Pendarves. It is one of the cochleomorphites of Dr. Plot, (Oxfordshire, Tab. VI. Fig. 11.) and what Lhuyd, in his *Lithophylacium*, calls the *Nerita fossilis*, N°. 312.

xiv. Blisters like reclined tubes, formed of parallel rings, as if worms or caterpillers half buried in the ground of mundic⁵.

xv. Buttony mundic in five perfectly globular protuberances.

Circular con-
cave mundics xvi. A wavy bordure, or cordon of brass-coloured mundic, pointed at one end, and at the other spreading into a circle, ending in a small cavity, and inclosing a larger in the shape of an inverted cone, which has three several stages of radiated fibres.

xvii. Several segments of circles, crested with a continued astragal, which edges a tuft of the largest-spangled brass-coloured mundic.

xviii. A piece of spangled brass-coloured mundic in relieve, with a fringed edging shaped by five segments of a circle ingrailed, or with the points where they meet outwards.

xix. This beautiful piece of lace-work is at o, sunk into the most exact circular cavity, from whence the six lifts or threads turn off on either hand, and protruding themselves into various angles, and preserving their parallelism throughout, trace round the extremities of this rare specimen. From a tin-mine, called Ludgvan-lez work, in the parish of Ludgvan.

xx. On the top there is a molding of fringy, tufted, brass-coloured mundic, which divides the spangled surface into compartments, as k, and makes the upper brim of the cavities with which this specimen is so distinguished. Below this tufted edge runs a most exact circular lift, b, b, b, which gives great regularity to the cavities underneath. This lift has little breaks in it, like an astragal

⁴ See of this sort two other specimens, Pl. XVI. Fig. xxxiv, and xxxv. page 141.

⁵ See Plate XVI. Fig. LIV, LV, LVI. page 141.

of bead-work in architecture. Beyond the circular cavities are some angular ones, as if for variety.

Fig. XXI. The colour of the highest polished silver, the circles most exact, somewhat concave, edged with a beaded astragal; *a*, is about the tenth of an inch deep, radiated as in the sculpture; *b*, has a taper hillock of the same spangled mundic in its center, and some faint traces of rays round it. This is part of a large rich incrustation of the plate-mundic on milk-white crystal. The specimen is one third of an inch thick, nine inches long, and five wide, at a medium, with seventeen cavities sunk in its surface, nearly of the size of what are here exhibited, five of which have in their center the little hillock, *b*: it coated the side of the mine, so that its surface was not horizontal but perpendicular. From the same mine.

XXII. On a greenish sparkling mundic, a list of small beads PLATE XVI edging like a gold twist, the flap (as it were) of a pocket, imbossed. Page 141.

XXIII. A mundic figure, imbossed in the shape of a spear's head, carved at the edge.

XXIV. On the top of a yellow-spangled mundic is this flower in high relieveo, lying single and entire, carved at the edges, sparkling with gold dust; it does not consist of circular lines only, but is a curious mixture of straight and spherical, not much unlike the form of an ancient harp.

XXV. An embossed flower, carved at the edges, like a goose-head, of gold-colour'd spangled mundic, covered with a sparkling ochrous glidder.

XXVI. A bird's head (as it were) embossed, on a thin plate of purple-spangled mundic powder'd in some parts with gold dust.

XXVII. A regular triangle of spangled yellow mundic carved at the edges.

XXVIII. Granules of brafs-coloured mundic placed in a rhomboidal order, fixed on white opake Quartz.

XXIX. A cluster of spangled mundic, with stems underneath, at *a*, *a*, perpendicular to their brim, fibrous, lacerated like the body of a broken nail; brafs-coloured, seemingly of the fungoid kind.

XXX. Crested with grains rectangular, spangled; at *b*, *b*, it has two stalks or supporters like the roots of a tooth, brafs-colour'd, fungoid.

XXXI. It's crest is tufted, the roots of parallel fibres or threads, like the fungi; marked transversly by three indented furrows; brafs-coloured.

XXXII. Crested as FIG. XXX. but not indented; fungoid.

XXXIII. Under a cap of leafy, rectangular mundic, *d*, a wavy girt or bandage, of mundic lace, *e*, *e*, surrounding the whole, the threads perpendicular, crossed and divided into fillets by protuberant lists;

lifts ; brass-coloured ; fungoid. There is a fungoid in stone, in Lhuyd's *Lithophylacium*, N°. 122, very like this specimen ; of which he also gives an Icon. He calls it *columellus fungum Niloticum Clusii, nonnihil referens, ex lapicidina Cowleiana* : These are all the φυλοειδ mundics I have met with.

Fig. XXXIV. Mundic stillatitious, in perpendicular, capillary tubes, both surface and texture smooth, of a cinereous lead-colour.

XXXV. A cinereous, stillatitious, tubulary mundic, the pipes of different diameter and lengths, and in regard to one another parallel as the pipes of an organ.

Geometrical
angular
mundics.

XXXVI. On the surface, thin wedges, acuminated, as if small bits of a knife or sword, not parallel, but with their edges turned upwards, standing out of the bed.

XXXVII. A shoot of mundic, columnar, the base at *f*, a rhombus, but at *g* the side angles are planed off, so as to make the column there hexagonal. Of plate-mundic.

XXXVIII. A rhombo-columnar clump of plate-mundic. The columns make different angles at their insertion ; the base a rhombus, which in one place has its ridge planed off, as at *g*, in the foregoing figure.

XXXIX. A rhomboidal single die of mundic, pale brass-coloured.

XL. A clump of intimately connected cubical mundic, polished, brass-coloured.

XLI. Two cubes of mundic inserted in each other's substance, therefore shot at the same time, but by forces differently directed. *N. B.* Where equally immersed, and of equal dimensions, the forces and materials were equal.

XLII. A perfect cube of mundic, of burnished brass-colour.

XLIII. A polyhedron ; its surface consisting of thirteen pentagonal planes.

XLIV. The surface is divided into twenty triangular planes, five of which make a pentahedral cuspis at one end, and five make the like cuspis at the opposite extremity, the other ten triangles compleat the space or fillet betwixt the two cuspides ; a most remarkable polyhedron this, and perhaps as curious a disposition of triangles as is any where to be met with. Brass-coloured.

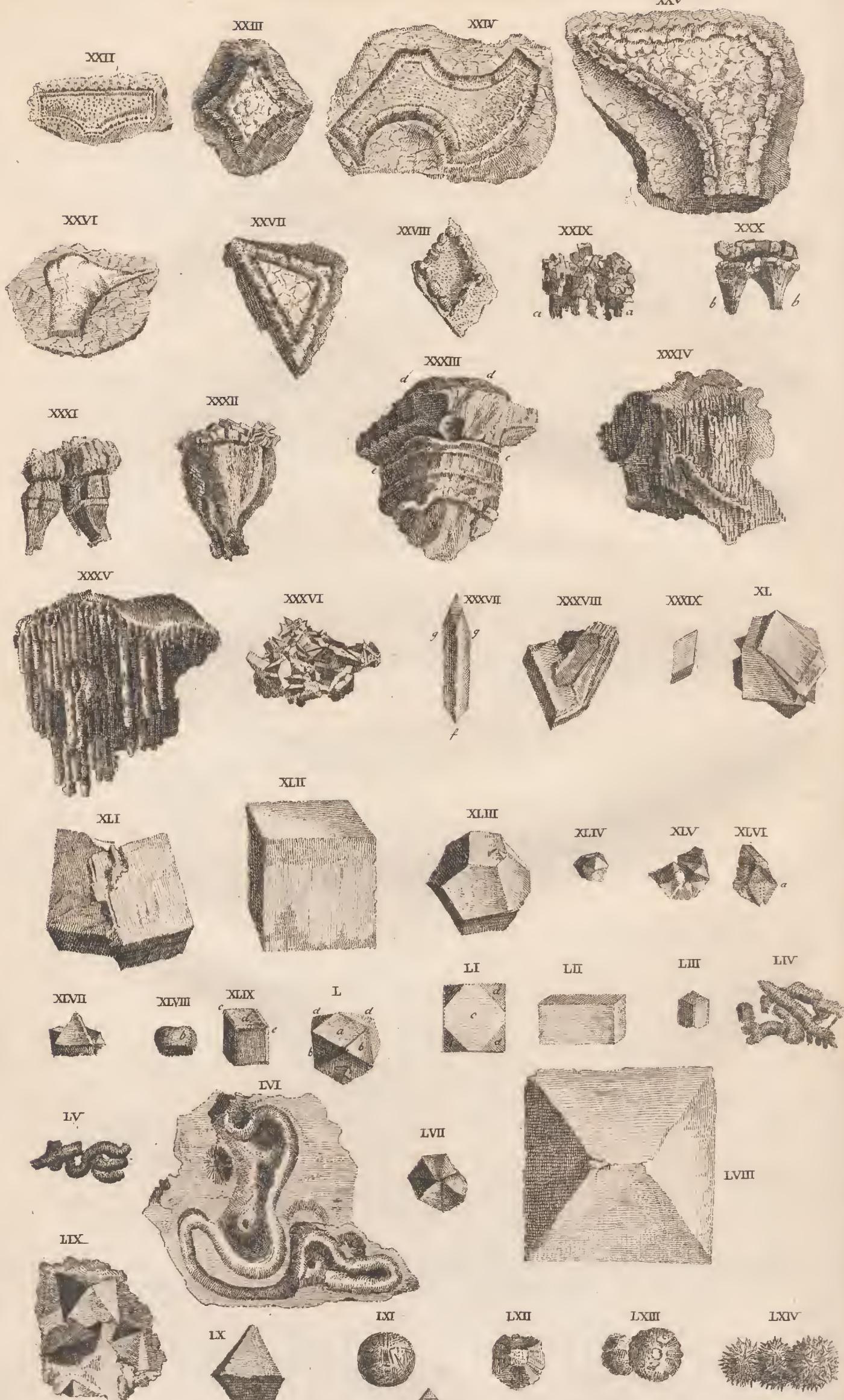
XLV. A bunch of mundic rhombus's with their points planed off.

XLVI. Another view of the same subject, shewing the front of the chief rhombus, as *a*.

XLVII. An exact equilateral triangular side of a mundic pyramid with a small one of the like figure on each side, in different directions.

XLVIII. One grain of mundic ; its sides and ends cut in the segment of a circle, and convex in the front, *b*.

Fig.



To M^r Harry Bassett of Haldane in Devonshire. This Variety of Mundics
in two Plates, engrav'd at her expence is most gratefully inscribd by Wm Borlase.

Fig. XLIX. A cubical die of mundic, with its rectangles planed off, as *c*, *d*, *e*.

L. A rhombus, *a*, betwixt four slopes; the two uppermost, *d d*, triangular; the two underneath, *b b*, incomplete triangles; their apices planed off. From Huël-Cock in St. Just, 1750.

LI. Another view of the same mundic-grain, exhibiting the octagon, *c*, betwixt four triangular slopes, *d*, *d*, *d*, *d*.

LII. A very exact parallelopiped of a gold-colour.

LIII. A cube of mundic with this peculiarity, that it has five of its eight angles with their apices as it were cut off, and yet of the same polished surface as the rest of the cube.

LIV. A piece of tubulary-wreathed, brass-coloured, sparkling mundic.

LV. Another specimen of the same kind, brass-coloured.

LVI. A vermicular scroll of mundic, thrown into irregular meanders as if once the habitation of an insect. *N. B.* These may be called *Vermicularia glomerata*, as Lhuyd calls the stony fossils of like shape (*Lithophylacium*, N°. 1215) from the stone quarries near Thame in Oxfordshire, and may serve to shew that we have extraneous fossils of the vermicular, as well as testaceous, and fungoid kind in mundic^o.

LVII. A heptahedral cuspis of yellow, polished-mundic.

LVIII. A tetrahedral cuspis of brass-coloured mundic, with two opposite sides quadrangular, two triangular.

LIX. Tetrahedral cuspides of mundic, the sides triangular.

LX. Two pyramids of a quadrangular plan joined base to base.

LXI. Wire-wrought, globular, buttony mundic, from the Pool copper-work, 1756.

LXII. Another variety of the same.

LXIII. A third.

LXIV. Three echinated balls of buttony-mundic connected. From the same mine.

Here we have in mundic the resemblances of plants and animals, the moldings, casts, and carvings of fancy, the figures of science and erudition, and more varieties will occur doubtless to those who search longer and with greater attention than I have done; but these are enough to surprize us with their regularity and art. The first of these may proceed from natural principles (such as mineral or metallic salts) determined to act in a particular manner, although to produce such a multiplicity of geometrical, spherical, and rectilinear figures, as are here exhibited, these principles must be very

^o The following figures are supplemental; the four first belong to the class of geometrical mundics, as the last four do to the convex circular mundics.

various; but to what shall we attribute those freer strokes of art, whereby the curved lines and lifts are sometimes plain, sometimes carved, as in Fig. xx. Plate XV. now radiated, now plain, as in xxI; now wavy, more numerous, and exactly parallel, as in xIx; now a mixture of straight and circular fillets, as in xx. Trigonometry, now straightlined, as in xxvII, xxvIII, &c. now spherical, as in xvII, xvIII. xxII, &c. and now the most elegant mixture of both, as xxII, xxIII, xxIV, &c. now plain, smooth globes, as xv; now wire-wrought, buttony, as lxI, lxII, lxIII, lxIV. now tubular and pendant, as x, xi. xxxIV, xxxV. now wreathed and vermicular, as xIV. lIV, lv, lVI. Shall we attribute this to a plastick power superintending the congress of fossils, and sporting itself with natural or preternatural representations; or shall we rather say, that the great power which contrived and made all things, needing no delegate, artfully throws the flexible liquid materials of the fossil kingdom into various figures, to draw the attention of mankind to his works, and thence lead them, first, to the acknowledgement, then to the adoration of an intelligent being, inexhaustibly wise, good, and glorious? Doubtless these are the works of that same lover of shape, colour, and uniformity, that paints the peacock's train, that veins the Onyx, that streaks the Zebra¹: It is the same hand whose traces we may discover even among the meanest and most obscure fossils. God loves symmetry, gracefulness, elegance, and variety, and distributes them for his own complacency as well as glory, limits them not to plants, and animals, and open day-light, but, like a great Master, habitually imparts them to all his works, though in the deepest ocean, and in the most secret parts of the earth.

C H A P. XIII.

Of the Fissures in which Metals are found; their Properties, Origine, and Use.

SECT. I.

TH E greatest part of our metals is found in veins or fissures, and the contents which fill these veins we call in Cornwall Lodes. We will examine the shell first, and then consider the kernel.

SECT. II. The sides or walls of a fissure do not always consist of one and the same kind of stone, nor are they equally hard; on one side

¹ The female Zebra, or wild-æs of Africa, was drawn and published by the ingenious Mr. Edwards, librarian to the College of Physicians, London, from the living animal belonging to his

Royal Highness the late Prince of Wales, and the male, still more remarkable for the regularity of its streaks, from the stuffed skin preserved in the College of Physicians, in the year 1751.

of the fissure there is hard stone, on the other sometimes loose clay; the walls, generally speaking, are harder than the lode they inclose, but sometimes softer; sometimes perpendicular, but much oftener declining somewhat to the right or left as they descend, but without any certain rule, and without any uniform relation to one another. Fissures are not of equal breadth or depth: The course of fissures (especially great ones) is generally east and west in Cornwall, yet in some places have a north and south direction; but in neither case do they exactly tend to the cardinal points: their course, to whatever point they are directed, is not in a straight line but wavy, full of little curves, alternately deviating from and recovering their chief direction; the curves they make are generally greater at crossing a valley than otherwise; the larger fissures have many lesser veins branching out from them, which decrease, like the boughs of a tree, as they become farther distant from the trunk, till they end in threads, and are no more to be found; these subordinate dependant veins join the master-fissure at different angles.

Let us now consider the origine of these fissures, and the cause SECT. III. of their several properties. As to their origine, the learned are not agreed. Some ^{imagine them to be the channels through which the waters retired at the time of the creation, that the ocean might be formed, and the dry-land appear; that where a large stream chanced to force its way, the passage became wide; where only a petty current, the passage was proportionably narrow:} but to this may justly be objected, that the walls of the fissures are too hard in many places for the waters to have penetrated, in others too soft to have resisted the least impetuosity of such a current. Their course does not at all agree with this theory; for they run mostly east and west, or towards the other cardinal points; whereas, if they had been formed by waters retiring into the sea, they would thither generally tend; but we find no such disposition, nor the least regard to the sea in their tendency.

Others think them ^{*} so many breaches of the *strata*, made at the conclusion of the universal deluge; whence it would follow, that there was neither fissure nor lode before: but that the lode was prior to the flood, the shodes*, which have been dispersed from the top of the lode by the flood, incontestably shew; and that the fissure must be prior to the lode it bears, is as evident as that the cabinet must have been made before the jewels could be inclosed and laid up in it. In such matters however it is more difficult to assign the true cause, than to confute the false ones; but in all

^{*} Agricola de ortu, &c. lib. iii. page 39. ^{**} Woodward's Nat. Hist. page 187. ^{* *} Loose stones.

such

such doubtful points, Naturalists are to submit their own sentiments to the examination of the publick, that by a variety of hints, and the joint assistances of all, the truth may at last appear.

First then those fissures are no more, as they seem to me, than the necessary consequences of the first settlement of matter, when it was divided into wet and dry, solid and fluid. That we may the more clearly apprehend this, let us recollect what happens to small masses of matter, cloven by like fissures, whence we may infer what is probably the cause of those greater clefts which we are now in search of. We all know that slime, diluted clay, and pulverized or dissolved stone, shall occupy more space in that state of moisture than when the same clay, slime, or stone, becomes dry and hard; and, from a parity of reason, we may argue, that when solids and fluids formed (and from a state of chaos became divided into distinct bodies) the parts of the former, being deserted by the latter, must needs grow closer together, and consequently leave chasms and crevices betwixt them. But the masses of earth, stone, and clay, were not at this time meerly passive; they formed larger and more compact bodies every where, in proportion to the quantity and mutual attraction of their similar parts, within proper distance. Hence arose firmer combinations, and consequently greater openings between such masses. Farther, it must be observed, that as all similar particles struggled to come into contact with each other, so, at the same time, they deserted, repelled, and expressed all dissimilar and contending particles; consequently masses of differently natured particles seceded and fled from each other, every party (if I may use the expression) tending to form and stick close to its like: betwixt such different substances therefore, attracted here, and there repelled, some chink or interval must needs happen. These causes then, *viz.* the desertion of moisture, the union of similar and the mutual repulse of dissimilar particles, must all have contributed to form the masses of our terraqueous globe into such separate portions as we now find them in; for that indeed it was not possible for bodies to grow dry and hard, unite and contract, without leaving some chasms or fissures between them. What ensued upon the hardening of particular and smaller masses, ensued also in the larger portions of the whole earth, in proportion to the quantity of solids united at any one effort, whether a grain, a *stratum*, a county, or a region. Hence therefore the cracks in all fossils, whether filled with heterogeneous matter or open; hence the clefts and separations of the *strata*, whether horizontal, perpendicular, or oblique; and hence the larger divisions or fissures which divide whole counties into as many subterraneous districts, whether charged with stone, metal, or earth, or kept open by the constant course of

of running waters. The largest fissures which we are apt to wonder at, extending themselves in one direction for so many miles, are no more to the body of the earth than the smallest, and to the naked eye invisible clefts in bricks, stones, and minerals; they are but so many terminations of the effort, whereby similar, soft, and moist bodies contracted themselves, and passed into drought and hardness. I need not say, that, according to this theory, the passage of the waters through those clefts was the consequence and effect and not the cause of these fissures, as Agricola supposed. Which is most likely, must be submitted to the candid reader; but the above account seems to be confirmed from a very common and just observation, that where the fissures are widest, there they are fewest; and, on the other hand, proportionably small where they are most frequent; both equal evidences, that the concreting glebes could not harden without cracking to a certain degree; that, where a large chink ensued, it answered all the exigencies of the contracting-mass; but where the crevice or easement to the forming-mass was but small, there many cracks did supply the place of a large one.

That the breadth, depth, and length of these fissures are all different, shews that they are not the effects of any exact rule, but the product of some natural immechanical operation, on a various, mixed, and unsettled congeries of bodies concurring to form themselves in different shapes, quantities, and positions.

There seems to be some uniformity in the direction of our Cornish fissures, pointing, as they generally do, east and west. In the coal and lead-mines throughout England, they generally do the same as Mr. Ray observes (*Physicotheol.* page 378); but, from such small spots, nothing certain can be concluded; and there are so many fissures in contrary and more oblique directions, that no uniformity in general can be presumed. The four principal veins of Potosi run north and south, and those of Oruro, reckoned the second best in Peru, have the same course, though on a different side of the mountain. At Schemnitz, in Hungary, the veins of silver-ore run north and south, other rich veins north-east; all veins keep not to the same point, even in the same mine." Brown's *Travels*, pa. 57. Of the gold-mines, in Schemnitz, some run to the north, some to the east, *ibid.* page 63. In the mines of Gottenberg, in Bohemia, the veins of silver and copper run south, *ib.* page 162.

That the north and south fissures should be generally smaller than the east and west ones, is merely accidental; for they are sometimes as large, and larger. In general, we may conclude, that the fissures were large or small in proportion to the activity of the contracting masses on either side. Again, as the forces of that con-

traction, which formed the master-vein, gradually ceased and died away, the subordinate cracks and little side-veins, proceeding laterally from the same forces, became less and less as they became more distant from the chief source of motion.

Position perpendicular.

Fissures are either perpendicular, inclined, or horizontal. The general position of fissures, at first, was probably the perpendicular or near it; for it is a common observation, that the fissure, which inclines much near the surface, grows gradually more upright, as it shoots deeper into the earth, where the *strata* are usually more compact, and consequently more apt to have preserved the primary position than those which are nearer the surface, and therefore more liable to have been disturbed.

Inclined.

Fissures inclined (that is, deviating from their perpendicular, as indeed most of them do) owe their obliquity partly to the first irregular contraction of the *strata*, and partly to some after-violences, whereby the neighbouring *strata* were unrooted, and, in proportion to their own subsidence, inclined and bent from their natural position every thing in their reach, as will more clearly appear in the examination of the properties of lodes in the following chapter.

Horizontal.

Horizontal fissures are owing probably to the accidental interposition of hard and different bodies, whereby the *strata* were kept from contact and settling close upon one another, and partly to the different efforts of the upper and under masses at their first induration. By either of these causes, or by both conjointly, horizontal chasms in the *strata* might be formed; but they are much less frequent than the perpendicular and inclined. We find them sometimes replete with metals and minerals, and call them floors, not lodes.

Some fissures are quite broken and discontinued, and the deserted fragment, from which they have been divided, found again at a small distance: this is also the effect of violence, and will come to be particularly explained among the properties of lodes.

SECT. V.
Use of fissures.

Although these fissures are the natural result of a moistened and mixed congeries of matter, passing by approximation of parts into a state of solidity and drought, we are by no means to conclude them useless, or the works of chance, produced without or beside the design of the first cause: No; the great Architect, who contrived the whole, determined the several parts of his scheme so to operate, as that one useful effect should become the beneficial cause of another. God provided for the uses of things in his first ideal disposition of them, and their respective beneficial uses flowed naturally from each other thus aptly disposed. Hence it happens that matter could not contract itself into solid large masses without leaving

leaving fissures between them; and yet the very fissures are as necessary and useful, as the *strata* through which they pass.

First, these are the drains which carry off the redundant moisture from the earth, which, but for them, would be too full of fens and bogs for animal to live or plants to thrive on.

Through these fissures the rain, which sinks beneath the channels of rivers, not having the advantage of that conveyance above ground, returns into the sea, bringing the salt and mineral juices of the earth into the ocean, enabling it thereby to supply the firmament with proper and sufficient moisture, and preserving that vast body of water the sea, wholesome, fit for fish to live in, and sailors to navigate.

In these fissures, the several ingredients, which form the richest lodes, by the continual passing of waters, and the *menstrua* of metals, are educed out of the adjacent *strata*, collected, and conveniently lodged in a narrow chanel, much to the advantage of those who search for and pursue them; for if metals and minerals were more dispersed, and scattered thinly in the body of the *strata*, the trouble of finding and getting at metals (those necessary instruments of art and commerce, and the ornaments of life) would be endless, and the expence of procuring exceed the value of the acquisition.

Lastly, without these fissures we could never make drains to our mines and quarries, and consequently neither metals nor marbles, neither salts nor earths, nor stones, could be so easily, or in such plenty provided as is necessary for the use of man.

C H A P. XIV.

Of Lodes; their Properties, Parts, and Inclinations, &c.

FR OM the fissures, let us proceed to that which they contain, SECT. I. and whatever fills them, whether clay, stone, mineral, or metal, we call in Cornwall a Lode, and not improperly; for a lode is very seldom rich, or equally impregnated; metals are local, distributed sparingly, not bestowed without reserve, found in some, not in all parts of the lode; but, where the lode is barren, it may serve to lead us to what is rich, whence the name lode of the same signification as the English word, lead, or led*.

First, let it be observed, that if the general run of the neighbouring *strata* be of any particular colour, be lax or compact, be SECT. II. Properties of
the lode. of a spar or crystal cement, be of slate, granite, or any other stone,

* From an old Anglo-Saxon word, lode, idem ac lead; so lode-stone quasi leading-stone. See Lye's Edit. of Junius ad verbum.

so will the lode be for the most part. Again, the substance of the lode is observed to be frequently the same, at the same level and depth with that of the *strata*; but though there is oftentimes such an agreement betwixt the lode and the *strata* near it, it is far from being always the case: in the fossil grammar there is no general rule without many exceptions, experience convincing us, that sometimes lodes are both as to colours and textures, as well as impregnation, entirely different from the adjoining *strata*^y. However, the general resemblance betwixt the lode and the ground adjoining, may probably conduct us to the true origine of lodes; for as soon as the fissures were made by the contraction of the *strata*, whatever did not join the hardening mass was carried off by the *expressed* moisture into the adjoining fissures, the waters depositing what they brought with them where-ever a proper *nidus*, or sufficient attraction to arrest it, occurred; that the little collateral veins are oftentimes filled, and at the same depth with like substance to the master-lode, will convince us that they were filled at the same time, by one and the same cause, and from one common repository. The contents then of the fissures proceeded from the nearest *strata*; and if the openings of the *strata* into the fissures were horizontal, then the cavities were filled at equal depths with the same substances; but if the communications were in any other direction, as frequently they must needs be, and indeed are so found, then the deposited matter is not found at equal depths in *strata* and fissure, but higher or lower, in such quantity and direction, as the vacancy of place, the opposition or compliance of other bodies, and the respective gravitations of the adventitious matter, shall have distributed it.

SECT. III. That part of the lode which is inclosed betwixt the two walls of the fissure, is called the body of the lode, but the fissure ending with the karn^z, the lode has its top covered over with a parcel of loose stones and earth, usually of the same impregnation, though in a less degree, of the same colour and cement as the lode, and this in Cornwall we call the broil of the lode. See Plate XVII. Fig. VII. D. p. 149. This broil not being confined betwixt walls, as the lode is, is frequently found to have been disturbed, and sometimes wholly dissipated, especially when the walls of the fissure reach up to day, as they do in naked karns; but where there is a layer of rubble or stiff deep clay above the fissure, which is much oftener the case, then the broil is always found covering the lode, and

^y Hutchinson is therefore too general in his following observation on the strata of Cornwall, Tracts, page 86. "Where the spar and the talk happen to be different at different depths in the

strata, there are *ever* the like in the same depths in the vein; that of the vein being *ever* of like kind with that of the *stratum*."

^z That is, the rocky *stratum*.

brooding,

Fig. I. Declination of the Strata towards Rivers.

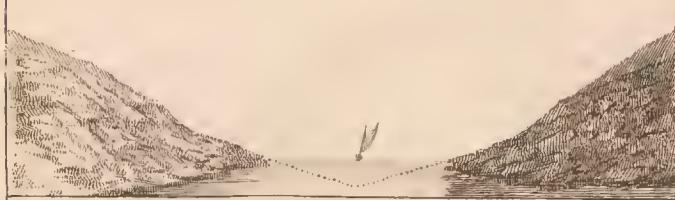


Fig II. Dipping of the Strata in Valleys.



Fig. III. Dipping of Sodas towards the Sea.

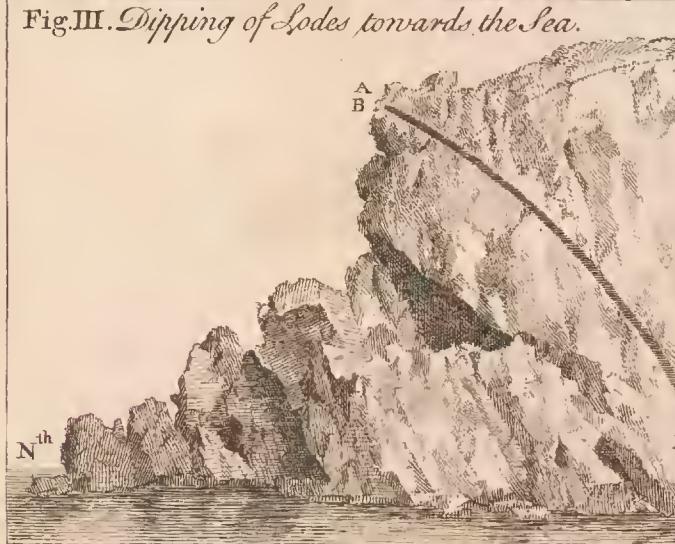


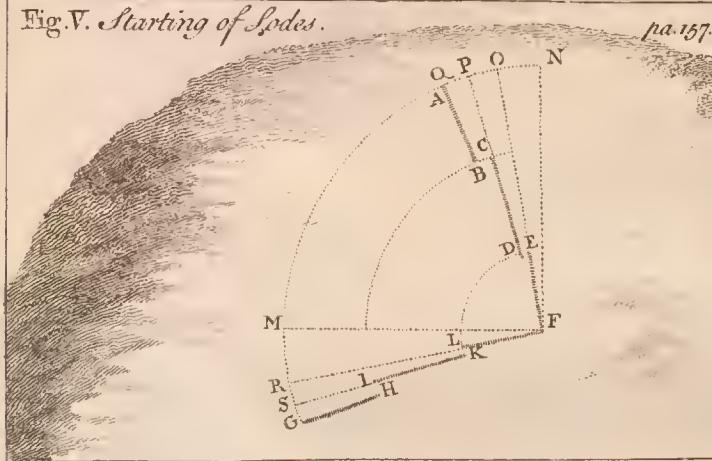
Fig.IV.

Dipping of Lodes in an Island.

See p. 155.



Fig.V. Starting of Spades.



7. Fig. VI.

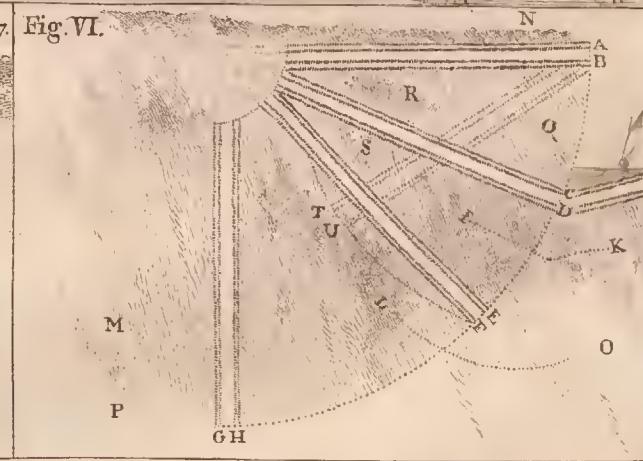


Fig.VII. Section of a Lodge, its broil, & shades. pa. 149 &c.

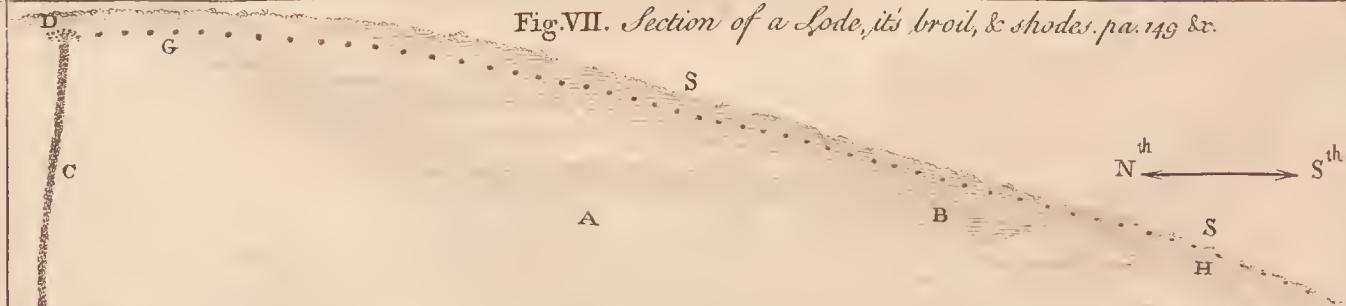
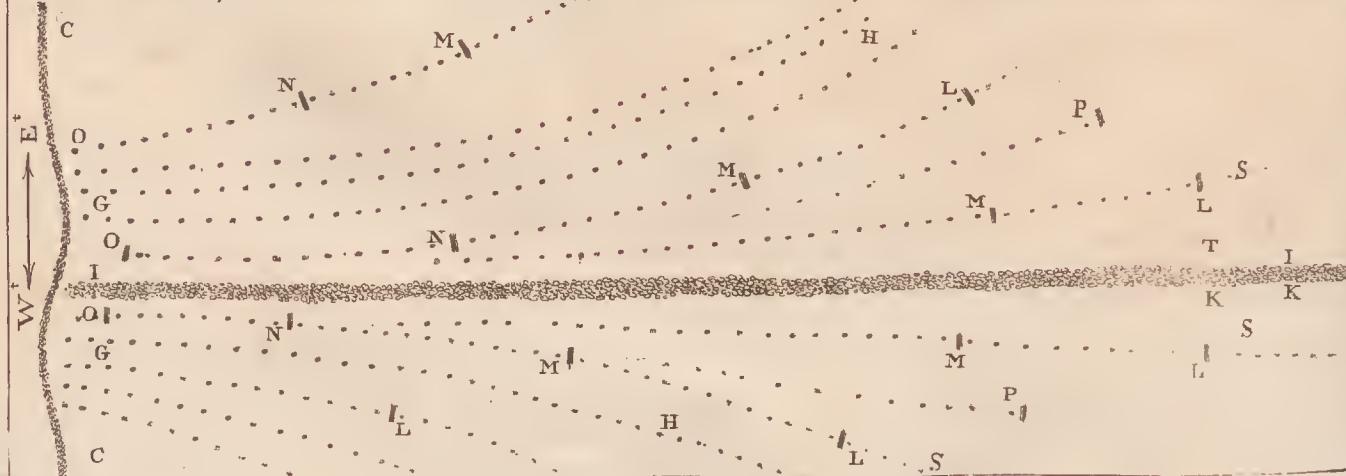


Fig. VIII. Plan of a Lode O, O, C,

L. - Its shades G, H, O, L, &c. shading shafts L, M, N, pa. 166.



brooding, as it were over the treasure underneath. It is supposed by some that this broil was collected and deposited where we find it by the waters of the deluge^a; but if the parts of the broil were fortuitously cast together, they would not be of the same nature with the lode underneath; they would also be found dispersed in other parts without distinction, as well as where they are; whereas they are found only upon and above the lode: in short, the broil is only the more shattered and less impregnated part of the lode, which, when the fissure was filled, wanted cement and a proper *nidus* to fix it into a more compact state; and being deserted, as it were, by the purer parts of the lode which settled below, became exposed to the impurities of the surrounding earths, and liable to be dispersed by floods.

First, The broil is found in greater quantity in the vallies than on the tops or sides of hills; in the level grounds, it is but just moved from its first station, and spread on each side the vein in an equable manner; but if the lode has any declivity near it, then many of the loose stones of the broil are found strewed down the hill. See Plate XVII. Fig. viii. M N O.

Secondly, The longer the declivity, the farther are these stones removed; but the shorter and steeper the sides of the hill are, the less distant they are found.

Thirdly, The smaller stones are carried farthest; on the contrary, the largest stones are nearest to the lode.

Fourthly, The smaller are also nearer to the surface of the ground, but the larger ones, deeper, and still deeper as you approach the lode, till the last are found contiguous to the lode itself. See Plate XVII. G, B, H. Fig. vii.

Fifthly, The farther distant these stones are from the lode, the fewer they are in number; but they multiply as you come nearer, and are always in greatest plenty next the lode.

Sixthly, These stones are known from all others by their being of a different colour and structure from the shelf, rubble, and other common stones of the ground where they lie, but more particularly by their angles being worn off; and the farther distant they are from the lode, the smoother they are; and the nearer, the less are their angles blunted. In Cornwall we call these dispersed parts of the broil Shodes^b. See Plate XVII. Fig. viii.

From daily observing the grounds they search, and the different SECT. IV.
substances they there meet with, the tinners can readily distinguish

Whence the
Properties of
Shodes.

^a "Loads usually covered with rubble and fragments cast upon the veins by the hurry of water," viz. of the deluge. Hutchinson's Tracts, vol. I.

tract ii. page 3.

^b Perhaps from the Teutonic word Shutten, to pour forth.

between what has been removed, from what has perpetually kept one and the same station ; the karn, that is the firm solid rock, seldom affords us any instances of alteration or movement, but every loose unconnected part of the earth has been moved and shifted ; and forasmuch as the transposed bodies are found to be moved more or less, farther or less distant from their former beds, according to their own specific weight, and the declination of the plane they moved on, it is the general persuasion of every intelligent tinner, that this change of situation can be owing to nothing but the force of water, and of no other water so likely as that of the universal deluge : neither are we to think this less the voice of truth, because it is so common an opinion ; for indeed the cause speaks so much for itself, that in order to confirm the justness of this reasoning, there remains nothing more to do, than to point out the correspondence and circumstantial agreement betwixt this assigned cause, and each particular effect and property mentioned before.

First then, In low and level grounds the broil is greater in quantity and less disturbed than on the tops or sides of hills, as being but just moved from its first settlement by the vacillating waters of the deluge on a plane surface ; whereas on a declivity, and a more exposed situation, the waters had more power to agitate and disperse, and consequently the original covering of the lode is much lessened in quantity.

Secondly, The gravitation of these stones (usually impregnated with metal) will, when moved with water, make them descend a steep hill quicker than down a more easy descent, in the same proportion as bodies moved on inclined planes, their velocity being in proportion to their own weight, the declivity on which they move, and the impediments they meet with there; but the quicker they descend, the sooner they get at rest, and fix by immersing themselves in the stiff clay and rubble, and *vice versa*.

Thirdly, The smaller shodes were moved to and fro easily and frequently, and consequently much dispersed ; whereas the greater and weightier the shodes were, the more they resisted the agitation of the waters, and were less removed.

Fourthly, The smaller shodes are usually found in and near the surface, being washed downwards, till, by the resistance of the ground on which they are spread, they are forced out like the rills of brooks into open day, whilst the larger, by their superiour weight, rest deeper interred, and nearer the lode.

Fifthly, The more distant shodes are found from the lode, the more they were dispersed by the water, and consequently became fewer in number in any equal space, like diverging rays ; and the nearer to the lode, the thicker and more frequent they remain for the same reason. See Pl. XVII. Fig. VIII.

Sixthly,

Sixthly, That the angles of these stones are blunted, proceeds evidently from the agitation of water, and they are smoothed in proportion to the distance they have been rolled; and had the force continued a sufficient while, these stones would have been as round as the pebbles on the sea-shore; but the farther we find them from the lode, the more trituration they have undergone, and *vice versa*.

It may be here objected, that if the deluge smoothed off the angles of these shodes, why had it not the same effect upon the loose parts of the killas, granite, marble, and other stones with which these shodes are intermixed? The reason seems to be this: The long, flattish, light, and sharp-angled parts of the broil continued their former situation on the top of the lode; they could not but be washed, yet they were not detached: those parts only of the broil which were stony nodules, impregnated with metals and minerals, upon every agitation rolled, and fell with forces in proportion to their weight; whereas lighter and flatter stones moved with less violence, and suffered little as to their extremities. This was the case in general; but where declivities were long rather than steep, and many little vallies concurred and discharged their contents, there, the force of the waters being increased, not only the tin-shodes are much rounded, but the granite and killas nodules; and every kind of stone, from a foot diameter and under, is rounded into a pebble-like form, as well as the tin, as any one may satisfy himself by observing the *strata* of rounded stones in the streamworks of St. Austel moor. Shodes therefore are not always metallic; they are sometimes barren. One thing more may be here observed, which is, that the broil is seldom so well impregnated as the lode underneath; the reason I take to be this: The broil, being more loose and shattery than the lode, has had much of its tin washed away by floods, whereas the metal of the lode lay more secure from such dissipation. Again: The broil being in position above the walls of the fissures, had no depth of *stratum* to draw the metallic particles from, had no chinks or collateral crevices for the waters to communicate the treasures of the adjoining *strata*, nor fissure to lodge and detain them: this is also the reason that the upper parts of the lode itself are seldom so well impregnated as those parts which lie deeper in the same vein, insomuch, that it is a common rule with the miners to sink upon lodes which are poor, it being generally found, that lodes prove richer in depth, than near the surface.

From the top or broil, let us descend, and take notice of the most remarkable properties of the body of the lode.

The

SECT. V.
Of the body
of the lode.

Its contents. The lode is either barren or impregnated. Many of our lodes in Cornwall are happily stocked with plenty of metals, but the richest are not equally impregnated in all parts, and numbers of lodes have nothing metallic in them: there is nothing constantly uniform in the bowels of the earth; metals are not more differently distributed among climates and countries than they are oftentimes disposed in different parts of the same mine. Hence arises great uncertainty and frequent loss in mining, the certain gain even here in Cornwall, where metals are in such plenty, being only the maintenance and constant employment of the labourers and artificers depending on the mines, and the consumption of materials which bring in a considerable revenue to the publick whether the adventurers gain or lose.

The lode is not so often two feet wide and more, as it is one foot and under; sometimes however it is wider, but, generally speaking, the smaller the lode the better impregnated ^c.

Lodes either consist of hard, solid stone, or are less compact, soft, and crumbly. If the adjoining *strata* have yielded plenty of liquid spar and crystal to incrust the metallic particles, then the tin or other metal is found inclosed in solid, hard, stony substance; but where nature has been more sparing of her cement, the ore is found in a lax, arenaceous, and rubbly state: both hard and soft lodes may be well and equally impregnated, but soft lodes are more apt to have their metals dispersed.

S E C T. VI. Lodes are seldom perpendicular; they decline as they descend, either to the right hand or to the left, but in very different degrees; and the same lode may decline in one part to one side of the perpendicular, and in another part to the opposite side. This declination increases as it approaches the sides of hills, and the cliffs of the sea-shore, of vallies and of rivers; but the same lode which shelves away quick at the declivity of a hill, or the approach of a precipice, when it gets upon a champaign plain ground, coasts it almost upright. Again: Lodes are not only inclined but fractured, and the inclined fragments found separated from each other by the intervention of earth stone, or both, entirely different from the lode; from whence it follows, first, that such lodes were formed before the fracture; secondly, that as the fracture must have been the effect of violence, and probably of a violent agitation, the inclination must have been also the effect of force, although in many instances that force only bent, and did not proceed to that degree of violence as to occasion a disruption of the lode; thirdly, the first direction

^c In the parish of St. Just (Penwith) the lodes are seldom wide, but the tin is of the best kind.

of the lode was the perpendicular, or nearly so, and the inclination and fractures are but two different degrees of variation from it. If therefore we can discover the probable cause of the inclination of lodes, the same cause, allowing it but a greater impetus, will account for the fracture. Now betwixt the inclination of lodes, and the dippings of the adjoining *strata*, there is oftentimes (tho' not always) so manifest an agreement and correspondence, that whatever occasioned the latter could not but produce the former. Let us first note the dippings of the *strata*; for if they have also been wrested, the lodes contained in them could not have preserved their station. As the original position of lodes was perpendicular, that of the *strata* was horizontal, each layer of stone, earth, sand, gravel, and their commixtures, resting (for the most part) according to their different gravitations, and spreading in belts and floors nearly parallel to the surface of the earth; but we often find these *strata* very sensibly declined from that, their first position; nay sometimes quite reversed, and changed into perpendicular. Thus, for instance, the rocks and ledges on each side of large rivers, laid bare by tides, are frequently observed to turn their points and thin edges down towards the chanel, intimating, that, from horizontal, they have dipped forward towards each other, making an angle in the middle, in which the waters pass, as in Plate XVII. Fig. I. page 149. Again: In sinking on the sides and bottom of vallies, we find the natural rock or karn, G, H, F. (Fig. II. ibid.) equally covered with earth and rubble, and running nearly in a plane parallel to the surface of the ground. For instance, at the hill, E, the karn shall be ten feet under the surface; in the bottom C, it shall be somewhat deeper, that is, more covered by what is washed off from the sides; and as it coasts upwards again to the hill D, it shall be buried only ten feet again, as at F. Now the lode which crosses such vallies, rises and falls, as the karn G, M, H, which cannot therefore be the natural first site either of karn or lode; for it is utterly impossible, that any fissure, being an open chanel, could contain in its sides M, L, K, any liquid (which all lodes must at first have been) if they were formed in such a curve-line; as much as that a syphon, if the tube was slit and open on one side, should draw water: this observation therefore will lead us to this further truth, that the subsidence of such vallies must have happened since the formation of lodes, and that the *strata*, in many instances, have departed from their primary position; which was to be shewn. But the *strata* have not only dipped in some places less, in some more, but from horizontal have become perpendicular. Now, when we see a wall lean, we conclude immediately that the foundation has given way according to the angle which the wall makes with the horizon; and

when we find the like declination in the *strata*, I should think we may conclude, by parity of reason, that there has been a like failure of what supported them, in proportion to that declination.

That we may trace these dippings through their several stages, let us suppose A and B (Plate XVII. Fig. vi.) two *strata* of clay or stone under the surface, N; if the ground gives way below, from R Q to S I, these *strata* shall sink into the position of C D; a declivity often seen on the sea-shores and the banks of rivers: if the subsidence be greater, reaching to L O, making with the horizon an angle of 45° (as in many steep sides of vallies we may observe) then A B shall descend and become E F; but if the ground recedes at M P, as well as falls, an utter subversion ensues, and A B shall become G H; that is, the *strata* from horizontal become perpendicular^a: on the other hand, if the subsidence under the *strata* A and B, be in the direction of S, I, O, then shall A B become T U, a position often to be seen in large inclined masses of cliffs on the edge of the sea^b.

If the *strata* then, in which the lodes are found, have departed from their original position, it is no wonder that lodes should partake of the same alteration; for whatever wrested the *strata*, must have proportionably affected the contents of such *strata*. Let us see whether the fact answers the theory.

In the vicarage ground of St. Just (Penwith) there is a tin-lode, to the north of which there is a valley, as C, Plate XVII. Fig. ii. accordingly the lode A B dips away towards this valley in the top, and underlies (as the tinners express it) into the hill D; that is, shoots away from A to B.

In a tin-mine in Rosmerguy cliff, in the parish of Morvah, the lode near the brim of the cliff, A B, Plate XVII. Fig. iii. underlies ten feet in six perpendicular; but this great and unusual dipping (for, if the lode varies from a perpendicular five feet in twenty, we generally reckon it a great underlying) grows less and less, that is, the lode approaches more and more towards a perpendicular line as it runs farther into the hill, so that when you come inwards from the cliff about one hundred fathom, and as deep as C D, Fig. iii. (above which the ground is level and champaign, as M L) the same lode becomes perpendicular, as D F.

This remarkable relation of inclined lodes to the next adjacent depression of the earth's surface (which might be confirmed by many other instances) will naturally lead us to conclude, that whatever made the *strata* fall so much awry, must also cause every thing included in those *strata* to fall proportionably.

^a This is the surprizing present situation of the *strata* of Caldy Island in Pembrokeshire, deservedly

taken notice of by Mr. Hutchinson, Tracts, vol. I. page 27, Edit. 2.

^b See O S H, Fig. iii. ib.

Suppose,

Suppose, for instance, T V W S (Fig. iv. Plate XVII.) a small island with four lodes A B, G H, I K, N O, running east and west through it. In the middle, where there has been no extraordinary secondary subsidence, (by which I mean a subsidence since the first division of solids and fluids at the time of the creation) the lode, G H, shall keep its natural perpendicular direction, and the *strata* lie on each other in their horizontal usual manner ; but subsidences and dislocations of the *strata* having happened near the edges or cliffs of this island, (as may be observed more or less in almost all cliffs) the lodes which run near the extremities, shall be variously affected. Suppose a lode, A B, in its original perpendicular position ; a subsidence of the *strata* happening underneath, the *stratum*, E D, sinks and becomes D F, then shall the lode, A D, subside also, and become C D, the inclination tending towards the general fall of the ground at T ; but if there be a lode on the other side of the island, as I K, where the dipping has been in a quite contrary direction, and the *stratum*, K L, dips so as to become K M, then shall the lode, I K, become inclined, as X K. If farther on, and nearer the edge of the cliff, at S, there be a greater dip of the the under *strata*, as from O Q to O R, then will the adjoining lode, N O, become inclined, as O P, and so proportionable to the dip of the *strata*, shall be the inclination of lodes.

Again : Where these subsidences below were extensive, and SECT. VII. have affected large tracts of ground, there is a certain uniformity in the inclination of lodes ; as, for instance, in some parishes in the western parts of Cornwall (as in St. Just) we generally find the lodes underlying towards the south ; but in the parishes of Gulval and Lannant, (the first about seven, the other ten miles from St. Just) they dip to the north as often as to the south, according as the subsidence prevailed. Where-ever the greatest subsidence was to the north of such tracts, the tops of the lodes would consequently point to the north, (as Plate XVII. Fig. iii. A B to C) and the lodes themselves underlye to the south ; and this uniformity would take place, notwithstanding the lesser dippings of vallies and low grounds in such districts ; for it must be observed, that vallies might in some measure diminish or vary, but could not always wholly controul or prevent the general tendency of such large masses falling with so powerful a *momentum*.

Again : Many vallies and depressions were the consequences of SECT. VIII. the first settlement of solids, and were therefore formed before the lodes themselves : it is no wonder therefore if we see lodes inclining sometimes without any regard to the declivity of such primæval depressions,

The uniformity of lodes in particular districts.

depressions, forasmuch as the lodes must owe their inclination to distinct and posteriour subsidences produced by a cause which we shall by-and-by enquire into. Another reason of some irregularities, is, that no subsidence could equally affect all the adjacent parts of so mixed a mass as the intestines of the earth are, nor all parts moved settle again in one direction ; from the texture of the earth, I say, it could not happen, but that the inclinations would be greater in one place than in another, nay some quite contrary to others ; and the fact is agreeable to the reasoning ; for we sometimes find two adjoining lodes of a quite opposite inclination, *viz.* one underlies to the south, as C D, Fig. iv. Plate XVII. the other, not twenty fathoms distant, shall underlye to the north, as Y Z, till both meet and unite at D, as in the mine called Huel-oules in St. Just. Such lodes will sometimes cross each other, as C, D, *a*, Y, D, Z, *ibid.* (as they do at Bartiny hill in St. Just) plain evidences that they proceeded from subsidences on the different sides of the lodes, *viz.* C D *a* from a subsidence at *a* Z *b*, and Y D Z from a subsidence at Z *a* *c*. Here is also plain evidence that these different subsidences happened at different times, for one lode descends in full body through the other : when they cross in such a manner, it is not easy to decide which of the two lodes was first formed. Mr. Hutchinson, in his Tracts of the Cornish lodes, page 19 and 20, thinks that these lodes which cross, (that is, run north and south) and run in full body through the main lodes, (which run east and west) were formed after the main lodes, which, by cracking, gave way for the cross-lodes to pass through them, an ingenious supposition, and most likely in general to be true ; but much will depend upon examining the inward structure of these lodes ; if that structure is uniform throughout in each, and different from that of the other, then Mr. Hutchinson's solution is right, and that which is cracked must have been prior to the other ; but if at the point of intersection, D, both lodes have nearly an equal mixture of the same feeders, stone, clay, or ore, then were the fissures inclined probably, and became replete at one and the same time, and filled with one common matter.

S E C T. IX. But that there have been different subsidences, and at different times, will still be more convincing, from another remarkable position in which we sometimes find our Cornish lodes.

Different subsidences provided from fractured lodes. In a mine called the North-Downs (a considerable mine of tin and copper near Redruth) when they find the tin-lode quite worked out at the bottom, and no farther appearance of a lode, either dead or alive, (that is, impregnated or not) with or without walls ; instead of sinking any farther, they drive across, and at a small distance

distance find a part of the same natured tin-lode as they worked before, and in the same direction. When the parts of the same lode are found thus separated from each other, the tinner's expression is, that the lode is heaved or started; and, as much may depend on the reader's clearly apprehending what is here meant, let us recur to the explanation of figures. Let A B (Fig. v. Plate xvii.) be the lode first wrought; the miners sinking till they come to B, there find no more lode; they sink a little farther in the direction A B, but to no purpose; guessing then from their experience in like cases that the lode is heaved, or, more properly speaking, started, they let alone the bottom B, and drive a level passage or drift to C; there, to their comfort, they find a part of the former lode C D; and having worked it down to D, where it disappears, they drive again across to E, and so work it down to F, or as far as it goes; and when they find it no more in that direction, repeat the same search to as good purpose as before, so that experienced workmen can tell nearly at what distance, and in what place, the started lode is surely to be found.

In the lands of Kelluz, in St. Erth, the lode is started to the north twenty-five fathoms; but this is looked upon as very extraordinary: the same fractures are observed in the coal-mines, where there are sometimes, though rarely, three dippings, (as Dr. Plot, Staffordshire, page 130, says) and the coal is said to leap: the colliers also from experience know where to find it again.

Now in this remarkable phænomenon, it first appears, that A B, C D, E F, are so many separate portions of the same lode; for they consist of the same *pabula*, the same metal, and make nearly the same angle with the horizon, and abruptly and equally vanish; being broken off at B D F, at one and the same distance nearly they appear again; all irrefragable evidences that they are not different lodes, but each a distinct *frustum* of the same lode.

Secondly, That this lode was formed before the fissure which contains it became inclined and fractured in this manner; for B was joined to C, and D to E, whereas now they are at a distance.

Thirdly, That there must have been three successive different shocks which could create three such fractures.

Let us see therefore whether the subsidence of the *strata*, the cause before assigned for the dippings of the lodes, will naturally account also for this their very singular disjointed state.

First then, from these and several other apparent alterations in the bowels of the earth, it is highly probable, that the *strata* were not only unrooted, shaken, and brought to fall, once only, or twice, but several times. Supposing then the lode N F (Plate XVII. Fig. v.)

SECT. X.
Cause of fractured lodes.

in its original perpendicular position, and M F a *stratum* spread on any precarious foundation to give way and descend to R L F, then will the lode N F descend also, and become O E F. A piece of the same *stratum*, R L, is afterwards unfooted, and becomes S I K, then will the lode, O E, fall in proportion, and become P C D. Another subsidence happens from like concurrent causes, and S I shall become G H; then shall that portion of the lode, P C, fall into the position of A B, and, in proportion to the times and falls of the under *strata*, shall the lodes descend either in whole or in part. It may be said, that if these subsidences were the causes of the above-mentioned fractures, then the interstices of such broken lodes would be filled by earth, clay, gravel, and such loose materials, as the disordered *strata* could not but throw into the opened crevices; this is very true, and the matter of fact confirms the speculation; for between B and C, D and E, (*ibid.*) a shelving soft congeries of rubble, clay, sand, or the like, (by the Cornish called a Flookan) is interposed: it is of a different substance from the lode and wall of the fissure, and by the vulgar is thought the cause of the lode's being started; but is indeed the effect, and nothing more than the deposit of the adjoining grounds after the fracture of the lode had been made.

S E C T. XI. As we have endeavoured to shew that the subsidences of the Cause of the *strata* were the cause of the inclination and fracture of lodes, it can-
subsidence of
the *strata*. not be improper to hint at the date and cause of these subsidences.

It has been observed before, (page 80) that, at the first induration of bodies, it was impossible, but that the surface of our globe should be higher in some parts, and lower in the rest; that the earth, porous and cavernous as it must be by the intermixture of substances apt to give way, ferment, and explode, must sink deep in some places, and less, or not at all, in other places. Now, as we owe the mountainous and hilly parts of our globe to the solids which stood firm and prominent, so to these depressions of the more lax and cavernous parts we owe the bed of the ocean, and the subsidence of vallies; but these depressions, so necessary, (the lesser to conduct the rivers, and the greater to contain and form the sea) could not but influence more or less all the adjoining *strata*, and the *strata* all their fissures and lodes; hence so manifest a relation in many parts to these first and principal depressions.

Secondly, When the sea was formed, its searching fluctuating waters washed and exhausted the looser substances from betwixt the *strata*, and time occasioned many subsidences of the higher upon the lower *strata*, which subsidences must have been in size and tendency according to the shape and dimensions of the vacancies from

from which such loose substances were educed, and not to their situation with regard to the sea. To these secondary subsidences we may ascribe irregular and contrary inclinations of our lodes.

Thirdly, When it was determined that an universal deluge should destroy all terrestrial animals, excepting only a small number preserved in order to restore the several species : to produce this deluge, the sea most probably was the chief instrument ; its bottom inflated, and raised so as to throw its waters over the highest mountains, covering them as a garment. When the Divine Justice was satisfied, the bottom of the sea returned nearly to its former level, yet not so exactly ; but that it left some parts above the sea (now islands or hills) which were before part of the ocean's bed ; the *strata* of those parts were therefore greatly disjointed, some inclining one way, some another, some quite reversed. To this dreadful catastrophe are we to attribute many irregularities of the *strata*, which have no correspondence or the least relation to the primary subsidences.

But whatever was the instrumental cause of the deluge, that there has been a deluge is the united voice of tradition, of Scripture, and of nature ; and from fact it appears, that this deluge dissolved all clays, earths, salts, and the softer stones, and must have occasioned great ebullitions and explosions among the pyrites, salts, and sulphurs, where-ever its waters pierced ; and hence happened very considerable subsidences in the protuberant parts of our globe, where the sea never before reached so as to affect the *strata*.

Lastly, a few subsidences may have happened since the deluge, from the same exhausting dissolvent powers of water, inundations, or by the force of earthquakes, but none could happen either first or last, from whatever cause, or at whatever time, without altering the situation of all solids within their reach, in proportion to the force with which they acted upon the adjacent grounds.

C H A P. XV.

Of Metals found in Cornwall; and first of Tin.

HAVING examined the fissures and the lodes, and their several properties most worthy of notice, we must proceed in the next place to the metals which our Cornish lodes contain.

Of metals Tin is the lightest, and therefore should be the first in our scale, if there were no other reason than the usual method of ranging metals according to their specific gravity ; but tin would otherwise deserve the first notice here, because it is in a manner the

peculiar

^e See page 78.

peculiar and most valuable property of this county, creating at home employment and subsistence to the poor, affluence to the lords of the soil, a considerable annual revenue to our Prince the Duke of Cornwall, and demanded with great eagerness by all the foreign markets of the known world.

SECT. I. How anciently tin has been raised in Cornwall cannot be precisely determined, but this county and Scilly isles (nine leagues distant from it to the west) were traded to for tin by the Phoenician colonies of Spain several hundred years before Christ. The Grecians and Romans, as soon as they applied themselves to marine expeditions, studiously insinuated themselves into the same traffick. Some tin was formerly found in Gallicia and Lusitania, but this seems to have been little in quantity, in an arenaceous state, with a few shodes intermixed^f.

To Cornwall therefore the commerce for tin principally tended, and here solely continued till about the middle of the thirteenth century after Christ, when a tinner of this county, being disengaged by Richard Earl of Cornwall King of the Romans, went into Germany, found the same metal, and taught the Saxons how to distinguish, search for, and dress their tin; and in Saxony, and some other places, there are at present such workings as supply some of those inland parts; but the quantity is small, and the expence of raising, and carrying it by land, is great. On the coast of Malabar, in the East Indies, some tin has been discovered of late years, and brought into Europe. Alonzo Barba^g tells us, that, in the Spanish West Indies, tin is discovered in several places, but the working of it neglected, because of the neighbourhood of richer metals; but the tin of Cornwall is superior in quantity and quality, and facility of exportation, to that of all the rest of the world^h.

SECT. II. Tin is found either collected and fixed, or loose and detached. In the first case, it is either accumulated in a lode, or in a floor, or interspersed in grains and bunches in the natural rock; in the second and more dispersed state, it is found either in single separate stones, called Shodes, or in a continued course of such stones, called the Beuhely; or, lastly, in an arenaceous pulverized state. Of which in their order.

SECT. III. The fissure and the lode have been already explained (chap. xiii and xiv.) The floor is a horizontal layer of ore. Mr. Hutchinson, sent into Cornwall by Mr. Auditor Harley and Dr. Woodward in search of

^f Pliny, lib. xxxiv. chap. xvi.

^g English translation, page 91, 92.

^h Woodward's Method of Fossils, page 52.
Cat. vol. I. page 5.

fossils

fossils¹, found none of this sort. “ I neither saw, says he^k, nor could learn upon enquiry, that there was either pipe, float, or belly of ore in Cornwall,” yet such there are, and in several places; indeed tin is not so often found in this position as in a lode, the same substance which fills the fissure, and there concretes into a wedge-like form, not meeting with so many horizontal as perpendicular cavities for it to rest in. The floors are found at the depth of many fathom, and sometimes very rich, as were Bal-an-uûn, in the parish of Lannant, and Huêl-grouan, in the parish of Breâg; and the same ore shall be sometimes in a perpendicular lode for several fathoms, and yet in depth diffuse itself into a floor. Where these floors are, the mines are ordinarily more dangerous, as well as expensive than others, the largest and strongest timbers being required to secure the several passages of the mine, and great care must be taken that supporters, though of the richest tin, be left untouched at proper intervals; for want of this caution (which never should give place to gain) the ground at Bal-an-uûn before-mentioned, for a large compass, and without any previous notice, funk down-right a few years since, and buried all the men below, and all above within reach of the fatal circle.

Tin-ore is also found dispersed in spots and bunches in the body SECT. IV.
of the stone, where there appears no fissure, lode, floor, or rectangular In spots.
intersections, as in other *strata*. These spots are sometimes so large
and numerous when in granite, (as in Trevegeon in St. Just) that
they well requite the labour of the tinner, though he is generally
obliged to blast the rock, and afterwards break it with sledges, in
order to get at the tin.

If these spots be in the blue Elvan stone (as we find them near
the Land's End) no iron will pierce the stone, neither can it be
blasted with gunpowder.

Tin is also found disseminated on the sides of hills in single SECT. V.
stones, which we call Shodes, (as is before observed) sometimes a In shode and
stream.
furlong or more distant from their lodes, and sometimes these loose
stones are found together in great numbers, making one continued
course from one to ten feet deep, which we call a Stream; and
when there is a good quantity of tin in it, the tanners call it, in the
Cornish tongue, Beuhel, or a *Living stream*; that is, a course of
stones impregnated with tin¹. In like manner, when the stone has
a small appearance of tin, they say it is just alive; when no metal,
it is said to be dead; and the rubble which contain no metal, is

¹ Woodward's Method of Fossils, page 55.
^k Tracts, vol. I. octavo, tract ii. page 1.

¹ See I K, Plate XVII. Fig. VIII. page 149.

called deads. These streams are of different breadths, seldom less than a fathom, oftentimes scattered, though in different quantities, over the whole width of the moor, bottom, or valley, in which they are found; and when several such streams meet, they often-times make a very rich floor of tin, one stream proving as it were a magnet to the metal of the other.

In the tenement of Douran, in the parish of St. Just, (Penwith) in the year 1738, there was a very singular stream of tin discovered; the ore was pulverized, betwixt one foot and one foot and a half in depth or thickness, of various breadth. In the moory ground, where it was first discovered, it had a back of soil and gravel over it, only two feet high, but, as the stream advanced farther to the east, it had still a higher covering, till at last it had all Douran hill (which may be about forty feet perpendicular) over it, the stream continuing still its horizontal position.

That this stream was collected from the adjacent *strata*, and then spread in this equable manner by the force of waters, is extreamly probable; but how it should become covered with such a large heap of rubble, clay, and gravel, as composes the hill of Douran, is not so easy to decide: there are indeed strong proofs, in some of the adjoining cliffs, of large heaps, very little inferiour to this in quantity, which were most likely laid where we find them by the waters of the deluge. But whether this remarkable position of arenaceous tin is owing to the waters of the flood (which indeed is a most fertile solution of subterraneous difficulties, but I fear too often recurred to) may be well questioned. It seems to me, that wherever there is an horizontal extended vacancy betwixt the *strata*, and at the bottom of that vacancy an even hard floor, either of stone, clay, or gravel, into which the waters cannot readily sink, and lodge their deposits in chinks and crevices, there the waters will spread their contents horizontally. Suppose then the *strata* of the hill of Douran to be well impregnated with this arenaceous tin, the waters percolating thro' the hill would by degrees congregate and wash it forwards till it met with such an horizontal floor as has been mentioned, which the tin, not being able by its weight to penetrate, must consequently spread itself upon the surface in breadth and thickness answerable to the vacancy which receives it; and this is most likely to be the case, and may happen under the highest and most rocky mountains which stood unshocked by the flood, as well as here at Douran under a gentle rising.

There are several *streams* of tin in St. Stephen's Branel, St. Ewe, St. Blazy, and other places, but the most considerable stream of tin in Cornwall is that of St. Austel moor, which is a narrow valley about a furlong wide, (in some places somewhat wider) running near

near three miles from the town of St. Austel southward to the sea. On each side, and at the head above St. Austel are many hills, betwixt which there are little valleys which all discharge their waters, and whatever else they receive from the higher grounds, into St. Austel moor; whence it happens that the ground of this moor is all adventitious for about three fathoms deep, the shodes and streams from the hills on each side being here collected and ranged into floors, according to their weight, and the successive dates of their coming thither. The uppermost coat consists of thin layers of earth, clay, and pebbly gravel, about five feet deep; the next *stratum* is about six feet deep, more stony, the stones pebbly-formed, with a gravelly sand intermixed: these two coverings being removed, they find great numbers of tin-stones from the bigness of a goose-egg, and sometimes larger, down to the size of the finest sand. The tin is inserted in a *stratum* of loose smoothed stones, from a foot diameter downwards to the smallest pebble. From the present surface of the ground down to the solid rock or karn, is eighteen feet deep at a medium: in the solid rock there is no tin. This stream-tin is of the purest kind, and great part of it, without any other management than being washed upon the spot, brings 13 parts for twenty at the melting-house*. In one of the workings here were lately found, about eight feet under the surface, two slabs, or small blocks of melted tin, of about twenty-eight pounds weight each, of a shape very different from that which for many years has obtained in Cornwall; and as they have no stamp on them, probably as old as the time when the Jews had engrossed the tin manufacture in the time of King John. They have semicircular handles or loops to them, as if to sling and carry them more conveniently on horse-back: they are much corroded by the sharp waters in which they have layn, a kind of rust or scurf-like incrustation inclosing the tin. Probably there were some Jewish melting-houses near the place, and when these houses were plundered and destroyed, some of the blocks remained in the rubbish, and by the floods, which this valley is so subject to, washed downwards, and covered where they were found. Their shape and dimensions may be seen Plate XX. Fig. xix. A is the upper-part, B the under-part of this ancient block of tin.

In the stream-works in St. Stephen's Branel, they also find now and then some small lumps of melted tin, two inches square and under: what I have seen of this kind cuts with difficulty, and more harsh and gritty than the common melted tin, owing to this perhaps, that the ancient melters had not then discovered how to flux

* Upon delivering twenty pounds of this tin-ore at the melting-house, the melter will contract

to deliver to the owner's order thirteen pounds of melted tin at the coynage.

their

their tin into the purity and toughness of the present age. These nodules I look upon also as fragments of melted tin scattered from the Jewish melting-houses.

SECT. VI. In sand and
slime. Tin is also found among the slime and sands of rivers and of the sea-shore, (as in some creeks of Falmouth harbour several lords of the soil have lately experienced to their advantage) washed down probably from the hills, and resting in such sheltered situations that the sea has not power to carry it off. This was probably the first position in which tin was discovered; for *טְן* in the Chaldee signifies slime, mud, or dirt; and when the Phenicians came here, and saw this metal in its slimy bed, they called it the Mud, by way of eminence, and thence has the name Tin (in Cornubritish Stean, in Latin Stannum) proceeded, and is still continued.

Not only creeks and rivers, but sometimes the open sea, (as I have seen in Mount's Bay) throws in the same metal to us in a pulverized state. In such open bays the tin comes probably from some lodes, which, lying bare to the sea, have their upper-parts fretted off, and by storms thrown in among the sands.

SECT. VII. In what sense
tin or other
metals grow. That tin grows, or is formed anew where there was none before, in any other sense than by approximation of like particles moved from one place to another, is, in my humble opinion, a mistake. That by fortuitous concourse (for what agency is it that conducts them) sulphur, quicksilver, or any other principles in different proportions, compressed by cold, or evaporated and supplied by heat, can be so exactly sorted as to form a metal, seems to me altogether as impossible as that the types of a printer should become words and sentences by being casually thrown together. The parts of metals are indeed variously involved, pass into different nidus's or cements, from malleable and metallic become lapideous, from lapideous again metallic. The ore is translated from one part of the mine to another, and is renewed where it has been exhausted; the metal is by fire or use wasted, dissipated, and lost; yet, if it could be recollected, might again become metallic; but tin is no where formed but by the peculiar metallic principles of tin concurring, nor iron but by those of iron. The formation of metals was not left to the accidental occasional combinations of distinct ingredients: their principles and criterions were all created in their proper kind; one metal or mineral may mix with another, and remain disguised for a time, but never changed. Sulphur and quicksilver, and other minerals as well as metals, may have tin in their substances, and by proper magnets and solvents, will doubtless dismiss that tin, and remain as much sulphur and quicksilver as they were before; but

so adroit and exact a mixture of any principles in the bowels of the earth, as to constitute one peculiar metal unalterably remaining itself, and not transmutable into any other, seems to me inconceiveable, if not impossible; the constancy, and immutability of metals, must be irrefragable arguments of their being created bodies *sui generis*, distinct from each other, and from all other bodies of the universe, and of their growing only by *juxta* position. However, learned men are of various opinions, and those more especially whose profession it is to resolve bodies into their original principles, and determine the number, sorts, and quantity of the ingredients which compose them^m. It is true all bodies which come under our observation are compounded, but, not to range beyond the subject of our present enquiry, every metal has its peculiar characteristick from which it will not depart, nor change into any other metal; each therefore has some distinct principle which others have not; for if all metals are but mixtures of the same principles in different portions and different degrees of refinement, why will they not by any subtraction of fire or solvents, or addition made to any one principle, become a less refined and inferiour, an intermediate or new, or a more refined and more valuable metal? In other words, why will not tin become lead or silver, and gold become copper, and *vice versa*?

Having now considered the several states and situations in which SECT. VIII.
tin is found, it must be observed, that tin does not appear so frequently in either or all of them together, but that people are perpetually searching after more, and endeavouring to make fresh discoveries.

To say nothing of dreams and fires by night, motives equally illusive, though prevalent still among the vulgar, few of the Cornish have ever heard of the *virgula divinatoria*, and its virtue in discovering metallic lodesⁿ, neither are they often (perhaps not so often as they should be) directed by the taste and colour of waters: the run of a lode is sometimes discovered by the barrenness of the surface and want or weakness of grafts in a particular furrow; thus in the tenement of Trenethick, in St. Agnes parish, though the field is cultivated equally in every part, you can distinguish the course of the lode, by the unequal growth of the grafts; this must be owing to one of these two causes, either there is so much mineral salt below the soil, that the roots of plants are parched,

^m See *Agricola de re met.* lib. v.

ⁿ The *virgula divinatoria* is a small forked hazel wand, which, being carried slowly over any area of ground, will bend, it is supposed, and in-

cline its upper twigs, (by admitting into it's pores the mineral steam) in case it passes over any metallic vein. Some persons in Germany are still credulous enough to be fond of these magical investigations.

or the earth and substance of the lode is so porous, that all the nourishment of the manure is dissipated, and sinks below, instead of being raised into the plants.

Much surer indications of treasure are often found in cliffs and caverns, where the lodes, being laid bare for some fathoms in depth, may easily be examined at its several stages.

Some of the curious will think that discoveries may be made by observing the position and alteration of the several *strata* as we descend in our mines; but there is no sort of uniformity to be assumed in the *strata* of one hill and those of another half a mile off, no relation betwixt the lodes and *strata*, as to depth, width, feeder, length, colour, or texture, and therefore no judgment can be formed from the situation of the *strata* in one place, where, how, or in what condition lodes are to be found in another place^o.

In order to make discoveries, some drive adits^p or drifts through their grounds, but few can prevail on any fellow-adventurers to bear so heavy an expence where the success is so precarious. It is much easier, and less expensive, and therefore most common to trace lodes by the scattered fragments of them called shodes (see pag. 149. sect. iv.); and as this is a kind of science which few tinners understand but those who have chiefly applied themselves to these researches, it will require more particular notice. If the shode is found in the vegetable soil, it gives no evidence of any lode's being nigh; but if in the *faſt*, (that is, the rubble or clay never moved since the flood) it is taken as a never-failing proof that it came from a lode farther up in the hill. As soon as the shode is found impregnated with tin, to find the lode it came from is the next care; the process consists in digging pits at a proper distance, depth, and in proper direction, and judiciously regulating their advances to the lode according as the properties of the shodes direct. First, the run of the lode being known to be in the hill above the shode, the several declivities below the hill, and where water may be supposed to have run with greatest force, must be considered, and there, at right angles to such force, must the shafts^q be placed crossing such declivities. For instance, let A B, Plate XVII. Fig. vii. page 149, be the section of a hill in which there is a lode running east and west at C; D is the broil or loose capping of the lode; S S the outward coat or surface of the ground; the shodes proceeding from the lode C D, shall be found courſing down the declivity of the hill in the direction of G H. Again, Fig. viii. Plate ibid. gives us the ich-

^o Something however of such recitals may be seen collected by Dr. Woodward, Cat. vol. I. page 201, &c.

^p Subterraneous passages for the water to run

off, and for better communication betwixt the several parts of the mine.

^q Called, in the Cornish tongue, Costeaning-shafts, from Cothas-Stean, i. e. fallen or dropt Tin.

nography or plan of the same lode and its dispersed shodes; C C is the lode; G H the course of the shodes: Suppose a man at S, on the declivity of the hill to have found a shode in the *fast*, well stocked with tin; in order to discover the lode whence it came, he sinks a pit or shaft, about six feet long and three wide, at L, above the place where the first shode was found (the pit may be about eight feet deep, more or less); and finding a shode like to the first, he proceeds up the hill to sink a shaft more at M, then at N and O; and if he finds the shodes less smoothed as he advances, growing deeper and in greater plenty than at first, he may confidently assure himself that he is growing nearer and nearer to the lode desired: finding at last at O, that the shodes lie as deep as the solid karn, he is certain to cut the lode C C in a few paces: if he does not find any shodes in the train L M, he begins in another direction, and sinks a side-shaft at P, or any place next adjoining, keeping the run of the hill still at right angles, till he finds a shode of like substance to the first, and then pursues the lode in the forementioned manner.

No one in Cornwall can search for tin in this or any other manner, where and when he pleases. If the land where the shode is found is inclosed and not *bounded*, the leave of the Lord of the Soil must be first obtained; if the land is bounded, then is the *bounder's* consent only necessary; but if the land is neither bounded nor inclosed, but a wastrel or common, then may any one mark out bounds there, (observing the legal forms) and search for tin. These bounds are the limits of particular portions of ground, containing sometimes an acre, sometimes more, but oftentimes less; they are little pits dug in the ground about a foot wide and deep, at the extreme angles of certain parcels of land, by drawing straight lines from which, the extent of these bounds is determined; in like manner as in geometry, by drawing straight lines from three or four points, the extent of a triangle or quadrangular superficies is known.

The lode being found, three things are necessary to be considered by the miner; first, to dispose of the barren rock and rubble; secondly, to discharge the water which every lode yields more or less, and generally in quantity sufficient to obstruct the labourer, if not duly attended to; thirdly, to raise the tin; and all these are easily performed when the workings are near the surface; but the difficulties increase with the depth, and skill and care become still more and more necessary, and indeed all the mechanick powers, the most forcible engines, and the utmost sagacity of the chief miners, is

SECT. IX.
Of bounds
and the right
for searching.

SECT. X.
Of mining as
now practised
in Cornwall.

is often too little and vain, where the workings are deep and many. Anciently they worked for tin, (especially when found disposed in floors) by laying open all the ground, as they now do in stone-quarries; several of these openings (called Coffens) are still to be seen in the parish of St. Just, and elsewhere; but this being a method too operose and expensive, it was not long, we may imagine, before the tinners learned to make passages into the bowels of the earth, of dimensions no more than necessary to examine the lodes, and bring off the ore; and this is what is properly called mining.

The arts necessary to mining are many, and every mine almost requires a peculiar management: mining therefore must be learned by practise, by experience, and masters; not from books, the rules of which, though ever so just, must be frequently suspended, altered, qualified, and superseded, according as the various circumstances require. Rather than attempt any directions, I chuse to give a description of one considerable mine from an actual measurement, intending that the reader may have a clear notion of the manner in which our Cornish mines are at present carried on.

SECT. XI. Fig. I. is the section of the pool-mine, exhibiting its several parts, and the underground workings.

*Explanation
of Pl. xviii.
in the follow-
ing page.*

A, black-ore shaft; B, house shaft; C, fire-engine, south front; D, North-house shaft; E, Little North-house shaft; F, Penhelic-house shaft; G, Water-Whim shaft; H, Roskeer shaft; III, the main adit, or principal drain; K, fire-engine shaft; LLL, Huel-dudnans lode when first discovered in single dots; M, Penhelic lode in double dots; N, South-house winds; O, hollow cylinders (some iron, some of brass) through which the fire-engine, C, draws up the water that it may run off through the adit, II; P, the several workings on the south lode, called Huel-dudnans, as they stood in the year 1746; Q, a drift to carry the water from the north lode to the bottom of the engine-shaft, X, on the south lode; R, bottoms of the great North-house on Penhelic lode, dotted; S, a dippa or pit with a force-pump to free the water; T, bottom of Huel-dudnans; V, Pen-helic deep bottom; W, little winds, that is, small shafts made from a drift in pursuit of the ore, and leading down to RX, the bottom of the fire-engine shaft, from whence the water of the whole mine there gathered together by various drifts and landers, or gutters of wood, is drawn up to the main adit, I; Y, grey-ore shaft on the south lode.

*Of Fig. II.
ibid.*

Fig. II. exhibits the plan of the two lodes worked by the pool-mine; *a*, the north or Penhelic lode in dotted lines; *b*, south or Huel-dudnans lode; *c*, black-ore shaft; *d*, house-shaft; *e*, engine-shaft, and summer-pole shaft; *f*, drift for the water of the north-lode;

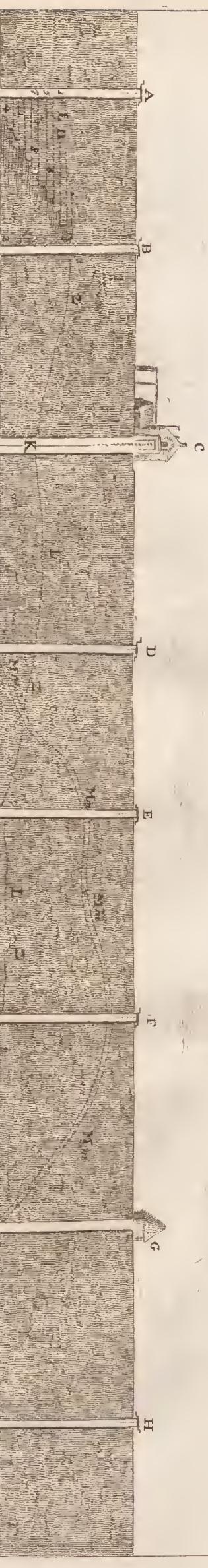
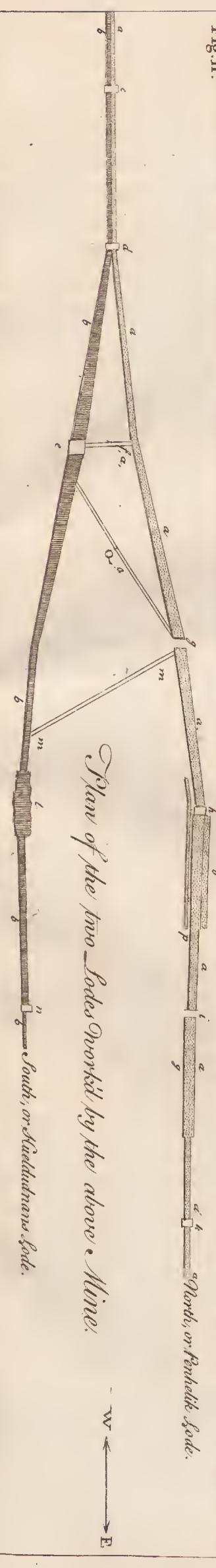
Section of the Foot-mine in the parish of St. Mewan, Cornwall, as laid Ch. W. pa. 168 &c.

Fig. II.



Plan of the two Sides worked by the above Mine.

W → E

lode; *g*, North-house shaft; *b*, Little North-house shaft; *i*, Pen-helic-house shaft; *k*, water-whim shaft; *l*, Huel-dudnans bottoms; the north lode is marked *a a a*, and dotted, the south lode is distinguished by perpendicular lines; these lodes joining at *a*, keep contiguous from *a* to *d*; then separate, and are of different widths as they advance to the east, and of different distances from each other, as in the plan. The rest of this figure the letters inserted in the different parts of the ichnography will best explain in the sequel.

In Fig. 1. which gives the section of these lodes, the height of SECT. XII. the south lode is known by the crooked line of single dotts at *L Z*, Progress of the works. the different risings of the north lode are marked with a list of double dotts or points at *M m*^r. There being a very hopeful discovery made at *L n*, *L Z*, and no getting at the riches by reason of the water; the adit, *I*, *I*, *I*, twenty fathoms deep, was driven up to the lode from the west, and having the two lodes in the shaft *A* at *L N*, they work with little expence down to the adit *I*; but finding the lode still rich, they sink on it down to *I P a*, searching the lode to the east and west as they descend, and bringing away the ore from drift under drift at *d d d*, where the men work in *stopes*, that is, in several degrees or steps one above another; the figures *1*, *3*, *4*, shew the mass of ore *L N*, *4*, almost exhausted in this manner, by twelve men working out the lode in twelve stope, at *5*, *6*, *7*, *8*. The miners finding the lode to hold the ore no deeper than *P a*, drive to the eastward, searching the bottom carefully, till, coming to *P d*, they find the ore there to deepen, and pursue it to the depth of *P b*; then drive and sink alternately as the lode gives encouragement, which in this mine was generally to the eastward; but *P e* shews that the lode was at that time rich to the west, which occasioned their pursuing it by that recefs. Whilst one party of tinners was thus engaged in the bottoms, the chief miners (called Captains) took the bearing of the lode with a well-approved needle (which they call dialling the ground), and sunk another shaft at *B*, as more convenient for getting at the lode at *Z*, and necessary to give air to the workmen, and draw the water, lode, and deads from the workings below at *P b*; and sometimes there are three shafts or more sinking on the lode at one time. Whilst the shaft *B* is descending to *P b*, the bottoms are carried forward in a step-like manner, wheresoever the lode invites, and the water permits. It will occur to the intelligent reader, that the fissure being cleared of so much ore, many vacancies in the mine must ensue; in these vacancies by putting timbers cross the fissure like beams, and laying planks of

^r These lodes were of copper and very rich, but the way of working tin and copper-lodes in equal circumstances is the same.

fir timber upon them, they dispose conveniently of a great part of the *deads*^{*}, an œconomy which has two good effects; it saves the expence of bringing those deads up to the surface, and, by filling the fissure at proper intervals, it prevents the adjoining *strata* from pressing the walls of the fissure together, which might otherwise be of fatal consequences. That the common labourers may be employed without confusion in breaking and rasing the ore, the captains see that they be properly disposed in the several parts of the mine; that they have necessary tools and implements ready provided; they are to examine the state of the mine, and provide for its security; see that the adit be sound and clear, that the shafts, hollows and looser parts of the mine, be well propped with timber; they are to see that proper communications be made and maintained between the several works of the mine[†]; more especially are they to inspect the ores, insist that they may be as speedily broke, as carefully separated from the deads and from each other, and as honestly brought up for the owner's use, as may be. But indeed their chief care, and what requires their constant skill and attention, is the management of the water, which in the Cornish mines is generally very troublesome, every cranny that is cut throwing forth it's water into the cavity where the miners work. To obviate this inconveniency the captain should be a kind of engineer, and well know how to collect, divert, and conduct, as well as raise the water. It is not expected indeed that the captains of mines should know how to build, repair, or rectify the several engines; for such purposes there is a professed undertaker, or engineer, but the captain is to take care that the engineer has immediate notice as soon as any thing goes amiss, that he has proper materials, and without delay attends to remedy the disorder. In order to this, the water must be convey'd over and beside the passages, and cross the openings of the mine by side drifts and gutters, so as all that possibly can may run off by the common drain I, I; what is below that level must be collected and drawn up to the adit. Where there are two lodes (as here, Pl. XVIII.) there must be ducts of communication, as *f a*, *Q a*, Fig. II. which serve to convey the water of the north lode into the cistern *e*, made in the south lode.

SECT. XIII. From such cisterns, judiciously placed, the water is raised to the adit I, I, sometimes by large buckets (in the Cornish tongue called Kibbals) best managed by the engine called the Whim, consisting of a perpendicular axis, on which turns a large hollow cylinder of timber (called the Cage) round which the rope (being directed down the shaft

* See horizontal planks from 5 to 6, and from 7 to 8, Fig. I. L n. Pl. xviii. † See m m, Q a, Fig. II. ib. by

by a pulley fixed perpendicularly over the opening of the shaft, winds horizontally: this axis has a transverse beam infix'd, at the end of which two horses fastened go their rounds, and draw more or less according to the number of circumvolutions in any given time, the largeness of the barrels, and the depth it is to draw. This is an engine which can only work in a perpendicular shaft, if the lode underlies considerably it cannot be used.

Another water-engine which the Cornish use is the *rag and chain*; ^{Rag and chain.} it consists of an iron chain with knobs of cloth (fenc'd and stiffen'd with leather) betwixt two and three feet asunder; the chain is turned round by a wheel of two or three feet diameter, furnish'd with iron spikes which inclose and keep steady the chain, so that it may rise through a wooden pump of about six or eight inches bore, and twelve or fifteen feet long, and by means of the leather knobs bring up with it a stream of water answerable to the diameter of the pump, and in quantity according to the circumvolutions of the wheel in any given time. This engine is worked usually by hand, but where plenty of water can be had, as in St. Austel moor, much more effectually and frugally by small water-wheels. Several of these pumps may be placed parallel upon different stages of the mine, as at *p d, p f, p g, p h*, Fig. I. Pl. XVIII.

Other pumps they have also, as the hand-pump, and the force-pump, which like the rag and chain will do well for small depths and little water, and are necessary in all *sumps*^u and the first sinkings into the lode, before the stopes can proceed.

More effectual is the water-wheel and bobs, an engine whose ^{Water-wheel and bobs.} power is answerable to the diameter of the wheel, and the length of the bobs fastened to its axis by large iron cranks; a perpendicular rod of timber to each end of the bobs, works a piston in a wooden, or (which is far better) a brass hollow cylinder, and the quantity of water exhausted will be in proportion to the bore of the cylinder, and the number of times which the piston moves up and down in any given space.

This is an engine very eligible where a sufficient quantity of water may be procured, but in summer, our superficial water in Cornwall (where we have few great rivers, and our brooks have no long course, and the mines are generally on high ground) fails much; so that many of these engines cannot work from May or June to October; a great hindrance at that season of the year when men can labour longer and with more spirit than during the other months.

^u Pits made in the bottom of the mine for the water, or for trying in depth beyond the general workings.

SECT. XIV. The most powerful as well as constant engine hitherto invented is the fire-engine. This engine is now well known to the learned, but as their books do not reach every where, and this machine is especially serviceable for the working of deep mines*, and of great advantage to the publick revenue, a general explication of it's principal parts, it's powers, and profit to the government, may not be improper. The principal members of this engine are exhibited in the plate annexed, N°. XIX. *viz.* the cistern or boiler T, (Fig. II.) the cylinder P, and the bob O, I, turning on an axis which rests on the middle of the wall Y. The following is the process of it's several operations: The cistern T, full of boiling water, supplies steam (by means of an upright tube and valve which shuts and opens) to fill the hollow cylinder P, and expel the air through a horizontal tube S, placed at it's bottom: the cylinder, as the steam rises, and the weight of the mine-water depending from I, K, L, preponderates, begins to fill with vapour, and the piston which plays up and down in the cylinder rises, and when it is got near the top opens a clack by which cold water is injected and condenses the vapour into nearly the twelve thousandth space which it before occupied, and the cylinder being then nearly empty, the piston of iron edged with tow and covered with water, (to prevent any air from above getting into the cylinder) is driven down by the pressure of the atmosphere (with the force of about 17 pounds † on every square superficial inch) nearly to the bottom of the cylinder; at this instant it opens the valve which lets in the steam from the boiler T, and then the piston ascends till it opens the condensing clack above, which brings it down again to open the under clack and admit the steam, and thus continues ascending and descending as long as the managers think proper; this process is quick, or otherwise, as the steam is by increase or subtraction of fire made more or less violent, to drive the engine faster or slower. To this piston the end of the bob O, is fastened by an iron chain, and as the piston descends in the cylinder P, this end of the bob is drawn downwards, and *vice versa*; as the end O is drawn down, the other end of the bob I, ascends, and by a chain, I K, draws up with it, from an iron or brass cylindrical tube, called a pit-barrel*, through a tyre of wooden pumps, (O O, Plate XVIII. Fig. I.) a column of water out of the mine equal in diameter to the bore of that tube, and in height to each stroke or motion of the piston in the cylinder P, and the sweep of the bob, I K. Many improvements have lately been added to this excellent piece of mechanism, among

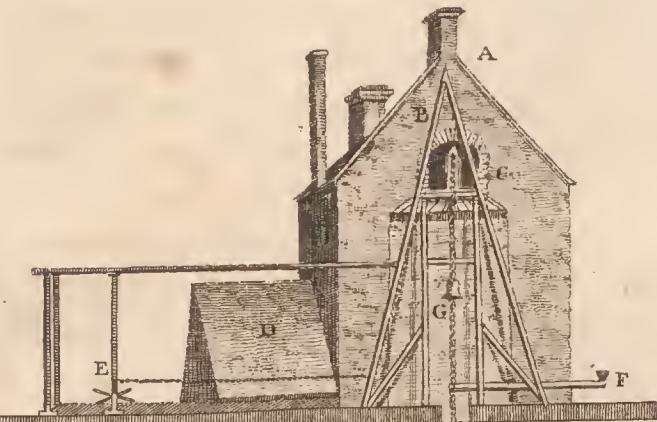
* By act of parliament the duty of coals expended in the working fire-engines in Cornwall is remitted.

† Seventeen pounds eight ounces and 347 grains according to Helfham.

* Letter X, Plate XVIII. Fig. I.

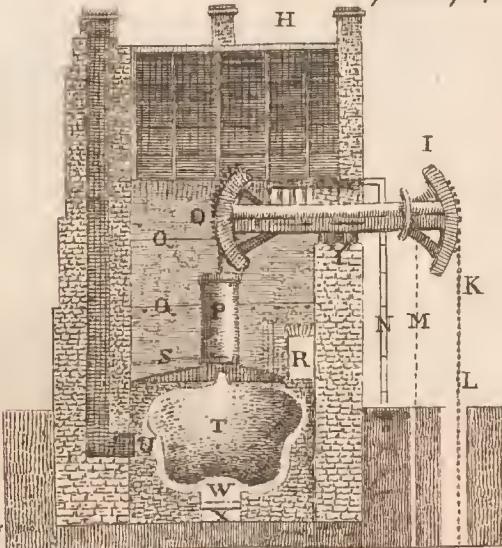
which

Fig.I.

South front of the Fire Engine.

10 20 30 ft

Fig.II.

*Section from the West of the Fire Engine
Explained p. 172*

24 ft

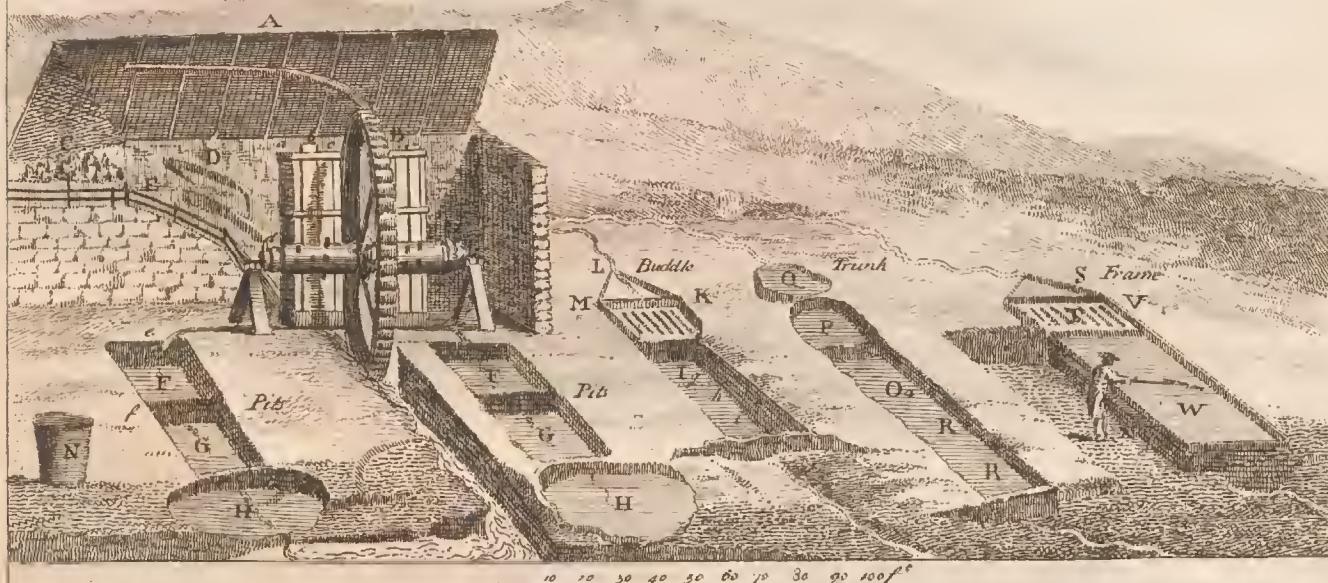
*Fig.III. Tin Stamping Mill & the works belonging to it
Explained. pa 177*

Fig.IV.

Porthanvow Cove in the parish of St. Just. Explained pa 176.

which I cannot but mention one in particular which is, that as this engine stood formerly, if the fire-men chanced to nod, the violence of the motion increasing with the fire, the weighty bob, O I, beat, shocked, and endangered the whole machine, and the fabrick it is inclosed in; but now when the fire is at the extreme height, and the bob begins to beat and strike the springs, it lets fall a trigger into a notch and stops the injection-cock, and the whole movement is stopped, till the injection of the cold water into the cylinder is restored; so that this engine is now brought to such perfection, that in a great measure it tends, regulates, frees, and checks itself; several subordinate members, wires, clacks, and valves are all moved, opened, and shut by the force of the steam, and the motion of the piston; inasmuch as that by enlarging the cylinder, and other parts in proportion, few Cornish mines are subject to more water than this engine will master: its power is in proportion to the diameter of the cylinder principally, the strength of the steam, and the depth it draws. This, here exhibited Plate xix. Fig. i. and ii. is the fire-engine which, in the year 1746, belonged to the pool-mine, Plate xviii. and the cylinder's diameter from the outer edge, was but three feet; but they make them much larger now; and it is imagined^y, that if they were still to increase the diameter of the cylinder, and make it also shorter than they do now, the force would be augmented, and though the column of water exhausted would be shorter, yet might this be well remedied by increasing the number of tubes, which the greater pressure on the piston would easily manage. A cylinder of forty-seven inches bore at Ludgvan-lez work, in the parish of Ludgvan, making about fifteen strokes in a minute, usually drew through pit-barrels of fifteen inches diameter, from a pump thirty fathoms deep, about an hogshead at each stroke, that is, fifteen hogsheads of water in each minute; so that the quantity of water raised in a given time, is as the square of the diameter of the pit-barrels, O O X, Plate xviii. Fig. i. and the height and number of the strokes in that time. But the cylinders may be made much larger; that at Herland (or Drenack) mine, in the parish of Gwinear, is seventy inches in diameter, and will draw a greater stream of water at any equal depth, in proportion to the square of its diameter. The only objections to this engine are the great expences in erecting, and vast consumption of coals in working it. To obviate these expences several methods have been suggested of increasing the elasticity of the steam and reducing the size of the boiler^z, which can be decided only by experience, and to that we must refer them.

^y See Philosophical Transactions, vol. XLVII. page 197, for the years 1751 and 1752. ^z Ibid. vol. XLIX. part ii. page 539.

Its principal parts.

Explication of the principal members of the fire or steam-engine, Plate xix. Fig. I. and II.

A, south front of the fire-engine house; B, triangle for tending the engine pumps, &c. C, arch for the main bob to play in; D, coal-house and fire-place; E, capstan, and cable for the triangle; F, Balance-bob to assist the draught; G, the bell.

Fig. II. H, section from the west; I, south end of the main bob; K, main chain to draw up the water from the bottom; L, end of the balance-bob, marked F, in Fig. I; M, a small chain drawing from the adit to a cistern, a; N, force-pump to supply the cistern, b, for the boiler T, &c.; O, north end of the main bob; P, the cylinder; Q, the planchings of the house; R, the eastern door; S, pipes to let out the air and steam from the cylinder; T, the boiler which supplies the steam; U, the damper, to moderate the fire; W, the fire-place; X, the ashes pit; Y, the axis of the main bob.

Its profit to the publick.

Before we conclude this section, let it be observed, that the people of Cornwall are not the only gainers by the introduction of this useful engine; the government participates the profit, and indeed without hazard: it may not be amiss therefore here to take a short view of the advantage to the publick revenue arising from the necessary materials used in our Cornish mines worked now by the fire-engines, such as ropes, candles, timber, powder, iron, coal, &c. the duties of which, together with the profit of four shillings *per* hundred weight for all tin raised in the three following mines, stand as follows:

The neat gain to the government from the mine (mostly of copper) called the North-Downs, in the parish of Redruth, in one month, (the drawback of the duty on coals consumed in the two fire-engines, amounting to forty-nine pounds fifteen shillings and six-pence, being first deducted) amounts to four hundred and seventy-nine pounds five shillings and six-pence.

In the mine called Pitt-louarn, Resnorth, and metal-works, the neat gain to the government (the drawback on coals consumed in two fire-engines, amounting to sixty-two pounds four shillings and five-pence, being first deducted) is two hundred and eighteen pounds and four-pence *per* month.

In Polgooth mine, in the parish of St. Mewan, the neat gain to the government (the drawback on coals consumed in one fire-engine, amounting to twenty-seven pounds eighteen shillings and four-pence, being first deducted) amounts, in one month, to two hundred and twenty-six pounds seven shillings and four-pence.

“ These

" These calculations have been so faithfully extracted from the account-books belonging to these mines, that the whole may be attested by affidavits, if occasion should require^a."

Hence it appears that the consumption of coals in the fire-engine is very great, the duty of coals consumed by these mines at five shillings *per chaldron*, amounting, in one month, to one hundred and thirty-nine pounds eighteen shillings and three-pence. The government prudently remits the duty on coals so expended, by which bounty, besides repaying itself for the duties remitted, it gains clear by these works, when in full working, five hundred and twenty-three pounds thirteen shillings and two-pence in one month; whereas, without this bounty, fire-engines would not have been erected, nor could these mines, nor many others in the county, ever have been worked, and consequently the loss to the government would be as their present gain. There are several other very considerable mines now worked by the fire-engine in Cornwall^b, by all which the government gains in proportion to the materials used, and the metal raised.

The tin-ore being raised out of the mine, is then divided into as many shares, as there are Lords and adventurers. The Lord usually hath a sixth-part clear of cost, but in consideration of draining the mine, and otherwise encouraging the adventure, is oftentimes content with an eighth, and sometimes a tenth. If the lands are bounded^c, then the bounder has the right of *setting*, or giving authority to search and work, and has the sixth clear, or as he agrees, and the Lord of the soil has only a fifteenth. The adventurers have in proportion to the part of the work which they carry on. These shares (which they term *doles*) are parcelled out, being first measured by barrows, and then carried into so many different heaps; every mine having the privilege (to the great regret oftentimes of the husbandman) of distributing and dividing the ore, on any the most adjacent parts of the field. As the barrows are carried off to their several divisions, one person, who is the reckoner, keeps an account by notching a stick at every barrow: if there be any fractions in the numbers to be divided, they then divide the whole into five or six or more parcels, according to the proportion of the Lord's and bounder's shares, and leaving those shares untouched, proceed to throw the remainder of the parcels all together into one heap, and then divide it easily among the adventurers; and it is surprizing

^a Letter from William Lemon, Esq; May 8, 1756, to whose accuracy and universal knowledge in the art of mining, I am indebted for these and other observations.

^b Huel-ritt in Godolphin-ball, Herland, Bulengarden, Dolcooth, the Pool, Bosproual, Huelrōs, and some others.

^c See before, page 167.

to see how ready and exact these reckoners are in dividing, though oftentimes they can neither write nor read. The parcels being laid forth, lots are cast, and then every parcel has a distinct mark laid on it with one, two, or three stones, and sometimes a bit of stick or turf stuck up in the middle or side of the pile; and when these marks are laid on, the parcels may continue there half a year or more unmolested; the property is fixed, and no one may add to, or diminish it.

SECT. XVI. What the ancient method was of preparing tin for the furnace,
Stamping and dressing tin. we cannot say; but Polybius the Historian is said to have described it, and that work is commended by Strabo⁴, but now lost with other valuable compositions of that judicious author. The short description which we have of the tin-trade in Diodorus Siculus (lib. iv. page 301, edit. Hanov. 1664) must not be omitted, though it is too general for us to learn many particulars from it. “These men (says he, meaning the tinners) manufacture their tin by working the grounds which produce it with great art. For though the land is rocky, it has soft veins of earth running through it in which the tinners find the treasure, extract, melt, and purify it; then shaping it [by moulds] into a kind of cubical figure, they carry it off to a certain island lying near the British shore, which they call Ictis; for at the recess of the tide, the space betwixt the island and the main land being dry, the tinners embrace the opportunity, and carry their tin in carts, as fast as may be, over to the Ictis (or port); for it must be observed, that the islands which lie betwixt the continent and Britain, have this singularity, that when the tide is full, they are real islands; but when the sea retires, they are but so many *peninsulæ*. From this island the merchants buy the tin of the natives, and export it into Gaul; and, finally, through Gaul, by a journey of about thirty days, they bring it down on horses to the mouth of the Erydanus, meaning the Rhone⁵.” In this description it will naturally occur to the inquisitive reader to ask, where this Ictis was to which the Cornish carried their melted tin in carts, and there sold it to the merchants. I really cannot inform him; but by the Ictis here, it is plain that the Historian could not mean the Vectis or Vectis of the ancients (at present called the Isle of Wight), for he is speaking of the Britans of Cornwall, and, by the words, it should seem, those of the most western parts. Της γαρ Βελαινικης κατα το ακρωτηριον το καλλιμενον Βελεριον οι καλοικυλες, &c. Ουλοι του κασσιλερον καλασκεναζεσι φιλοιεχνας, &c. that is, “those who live at the

⁴ Geogra. lib. ii.

⁵ Rhodanus, says the Latin translation; to Mar-

feilles, says Pausanias, in Strabo, lib. iii. page 147, edit. Par. 1620.

extreme end of Britain, called Belerium¹, find, dress, melt, carry and sell their tin, &c. Now it would be absurd to think that these inhabitants should carry in carts their tin near two hundred miles, (for so far distant is the Isle of Wight from them) when they had at least as good ports and harbours on their own shores as they could meet with there; besides, these inhabitants are said, in the same paragraph, to have been more than ordinarily civilized by conversing with strangers and merchants. Those merchants then must have been very conversant in Cornwall, there trafficked for tin, that is, there bought, and thence exported the tin, or they could have no business there, their residence would have been in some of the ports of Hampshire, and Cornwall could scarce have felt the influence of their manners, much less have been improved and civilized by them at that distance. Again: The Cornish, after the tin was melted, carried it at low-water over to the Ictis in carts; this will by no means suit the situation of the Isle of Wight, which is at least two miles distant from the main land, and never (as far as we can learn) has been alternately an island and a *peninsula*, as the tide is in and out. The Ictis therefore here mentioned must lye somewhere near the coast of Cornwall, and must either have been a general name for any *peninsula* on a creek, (Ik being a common Cornish word, denoting a Cove, Creek, or Port of traffick,) or the name of some particular *peninsula* and common *emporium* on the same coast, which has now lost its istmus, name, and perhaps wholly disappeared, by means of some great alterations on the sea-shore of this county. But to return: If this art of manufacturing the tin was ever at any great height among the ancients (as this author seems to intimate), it has had its rises and falls like all other arts, for so late as the reign of Elizabeth, the process seems to have been in a state of imperfection, and to have been greatly altered for the better, by the then Sir Francis Godolphin of Godolphin, Knight, as Mr. Carew informs us (page 13 and 153); it has been improved since that time, and is still capable, I believe, of farther improvements. It will therefore be the more excusable to give a detail of this process, and set forth the whole method of ordering the tin-ore, as it is practised by the most skilful artists of the present time, illustrating the same with the mill, and the several works subservient thereto.

The tin-ore being divided, is then (as every owner's opportunity serves) carried to the stamping-mill, and deposited on the area or floor at C, Plate xix. Fig. III*. If the ore be very full of clammy slime, it is turned from the area, C, into a pit near by, called a Buddle, L I, to make it stamp the freer without choaking the furnace.

¹ Now called the Land's End.

* Page 172.

grates, and brought back to C. If the ore is not slimy, it is shovelled forward from C into a sloping chanel of timber, E, called the *Pas*, from whence it slides by its own weight, and the assistance of a small rill of water, D, into the box at Y; there by the lifters, a, b, c, falling on it after being raised by the axel-tree, d, which is turned round by the water-wheel, B, it is pounded, or stamped small: to make the lifters more lasting, and fall upon the ore with the greater force, they are armed at the bottom with large masses of iron of one hundred and forty pounds weight each, called Stamp-heads; and to assist the attrition, the rill of water, D, keeps the ore perpetually wet, and the stamp-heads cool, till the ore in the box, Y, is pulverized, and small enough to pass through the holes of an iron grate at Y. The grate is a thin plate of iron, no more than the tenth of an inch thick, one foot square, full of small holes punched in it about the bigness of a moderate pin, not always of the same diameter, but as the different size of the tin granules requires; for the larger the crystals inclosing the metals are, the larger must be the holes, and *vice versa*; so that in suiting the grate to the nature of the tin, the skill of the dresser appears. From this grate the tin is carried by a small gutter, e, into the forepit, F, where it makes its first and purest settlement, the lighter parts running forwards with the water through holes made in the partition, f, into the middle pit, G, (much of the same shape and size as the forepit) and thence into the third pit, H; what settles in G and H is called the *slimes*, and what runs off from them is good for nothing. The forepit, F, as soon as full is emptied, and the contents carried to the buddle, I, a pit seven feet long, three wide, and two deep: the dresser, standing in the buddle at I, spreads the pulverized ore at K, called the head of the buddle, in small ridges parallel to the run of the water which enters the buddle at L, and falling equably over the crofs-bar, M, washes the slime from the ridges (which are moved to and fro with a shovel) till the water permeating every part, washes down the whole into the buddle, I: whilst the dresser's hands are employed in stirring the ridges at K, he keeps his foot going always, and moves the ore to and fro, so as the water may have full power to wash and cleanse it from its impurities; the buddle fills, and the tin is sorted into three divisions; that next the head, at g, is the purest; the middle, at h, is next in degree; that at i most impure of the three; and each of these divisions goes through a different process: the forepart, at G, is taken out first, and carried to a large tub, N, called the *Keeve*; there immersed in water, it is moved round with a shovel for a quarter of an hour, by which means the impurities rise from the ore, and become suspended in the water; the tin-ore is then

Buddling.

then sifted in a sieve purposely constructed, and if it needs, must be sent to be buddled again, then returned to the keeve and worked as before with a shovel, which they call *tozing* the tin: the keeve is then *packed*, that is, beat with a hammer or mallet on the sides, that the ore within may shift and shake off the waft, and settle the purer to the bottom. The foul water then on the top of the keeve is poured off, and the *fordes* which settles above the tin, is skimmed off, and what remains is pure enough to be sent to the melting-house, and is then called Black-tin. The waft skimmed off, is carefully laid by to undergo another washing. Whilst the forepart of the buddle, I, is thus manufacturing at the keeve, another hand is moving forth that part of the buddle, h, in the same manner as g was before; and in its turn that, and the settlement at i, is promoted to the keeve, and thus what is deposited in the forepit, F, is *brought about*, as the tinners term it, that is, undergoes all the necessary lotions.

What runs off from F, into G, and H, must be dealt with in another manner. The contents of these pits consist of the small and lighter parts of the ore, and are intimately mixed with a greater quantity of earth and stone bruised to dust by the mill. These are called the *slimes*, and are carried by some boys (mostly under fourteen years of age) by direction of the chief workman, to the trunk O, whose head (called the Pednan) is a semicircular pit, wherein a boy moves the slimy tin round with a little shovel that the water (which runs into P from Q; called the Strakes) may wash away both the filth and tin over a cross stick or board about ten inches deep: the board is somewhat lower in the middle than at each end, for admitting the watry mixture with more ease into the body of the trunk, O, R, R, which is a pit lined with boards ten feet long, three wide, and eight inches deep; that which rests in the forepart of the trunk at O a, is carried off to be *framed*, and the settlement at R R, is moved forward to P to be trunked over again before it is fit for the *frame*. The frame, T W, consists of two planes of timber; the body W, the head T. The water falling in a gentle manner from S upon the head T, washes the ore, which there offers itself (as at the buddle) in little ridges, downwards over a slope piece of timber, U, called the *Lippet*, into the body of the frame W. Upon this frame the water is spread so thin, and runs so slowly, (the plane being nearly horizontal) that by moving the slimy tin to and fro with a light hand, and exposing it cautiously to the water with a semicircular rake, all the *fordes* is washed away, and the tin, though ever so small, remains on the frame near the head; when the tin is found sufficiently clean, the body of the frame, which is fixed on two iron axes, called Melliers, one at the head,

the

Trunking
the *slimes*.

Framing.

the other at the foot, (by slipping the stake which supported it) is turned easily from horizontal to perpendicular, and the tin, which remained on the frame, runs off, by the assistance of a little sprinkling, into a wooden chest, X, called the coffer, which lies below ready to receive it; the frame is then righted into its horizontal position, and the same process repeated, till the coffer is full; the contents are then carried to the keeve N, where they are tozed, sifted, and packed; the ore is then carried back again to the frame, W, and *cazed*, which is performed by stopping the lower end of the frame with slime and turf that the water may be quite still, and the tin more easily settle upon the frame, and descend the more surely into the *coffer*; the coffer is then emptied the second time, the tin carried again to the keeve, there tozed, skimmed, and packed; and thus the slimes are finished, and brought to as great a degree of purity as the size of the tin (which, being exceedingly small, will necessarily have somewhat more of wast than what is larger and heavier) will permit.

Thus proceeding only upon this single principle, that the force of water, properly applied and introduced among the particles of ore, and the fordes mixed with it, will disperse the latter, and leave the former at rest for them to collect and treasure up, they vary their operations inconceivably, conducting with great ingenuity, lessening, increasing, diffusing, or contracting their water (the great instrument of purity), as the size, weight, and combinations of the metal and its feeders do require; indeed, it is surprizing to see with what ease, cheapness, and regularity all these several processes are performed.

It must here be remembered, that mundic, and some other semimetals, being specifically heavier than the tin, whatever tin-ore is incorporated with these must first be burnt, and the sulphur, &c. evaporated, and then, and not otherwise, will the water wash away the remains of the semimetal, and leave the tin behind. This busines of *dressing* is a particular trade, entirely different from that of the labouring miner, and is best learned under a master-workman, who makes it his sole occupation to follow the stamping-mill, and the works belonging thereto. This master-workman hires boys from seven or eight years old to eighteen, gives the former about three shillings a month, and raises their wages as they advance in age and workmanship, till they have man's wages, viz. at the least twenty-four shillings, at the highest thirty shillings *per* month. This is of double benefit to the poor parents; the boys being taken in so young become healthy and hardy by using themselves to cold, and to work with wet feet all day; and, 2dly, they learn early to contribute to their own maintenance. Each stamping-mill, which has constant

constant work and water, will employ one man and five boys; and one hundred sacks (each sack containing twelve gallons) are stamped, washed, and fitted for melting at the rate of six-pence *per* sack (or fifty shillings *per* hundred) more or less somewhat, according to the quality of the ore, in the space of a few days. For bruising the tin-ore into a finer powder, formerly they used the crazing-mill (Carew, page 12) after the ore was stamped, an engine not much unlike the present grist-mill; but Sir Francis Godolphin before-mentioned (as it is supposed) either invented or improved this much more effectual engine the water stamping-mill here exhibited, so as it might serve all purposes, and the other has been ever since disused.

Tin, being *dressed*, is carried in sacks under the general name of SECT.XVIII. Black-tin (though what is called Frame-tin is usually of a yellow-^{Of melting}
^{tin.}ish earthy colour, and some other ruddy brown, and some cinereous and whitish) to the melting-house upon horses, each horse carrying about three hundred pounds weight. Here, the parcel brought is first assayed; in order to which, either the whole parcel is emptied into clean timber hutches, and there well mixed, or a little out of every sack is taken by the assayer, and well mixed together, that the assay of that little parcel may ascertain the real quality of the whole: for it must be observed, that although the process of cleansing all sorts of tin is nearly the same, and after this cleansing all goes by the name of Black-tin, yet each parcel of every work may be of different value, according as it is more or less skilfully dressed, and according as the different *pabula* with which it is incorporated do either promote or obviate the fusion of the metal. That this “black-tin therefore is ever all of the same richness and yields alike,” as Dr. Woodward^s was informed, is a great mistake. Kal, for instance, *viz.* wild-iron, is reckoned to mix well, and melt kindly with tin-ore, and increases the quantity of melted tin in a greater proportion than the quality is thereby debased, as we find by that of Huel-boys mine in St. Just, and that of other places; such ore will therefore yield one quarter of a twentieth part more than ore of a much finer appearance to the eye. The melter is not paid in money for melting the tin brought, but by allotment of such a share in twenty: for the charges of coals, labour, and utensils, expended in the fusion, the melter has usually $\frac{8}{20}$, the other twelve in twenty parts remaining to the owner: some tin however will bring the owner twelve and a half and thirteen out of twenty, which is the most that is given: on the other hand, some black tin has such a quantity of other metal, or of its own stubborn feeder adhering to it, that it will not bring more than

^s Catalogue, vol. II. page 31, m. 26.

eight for twenty to its owners. The melter having bargained for the parcel brought, gives his note to deliver the quantity of white tin agreed upon at the ensuing coinage, and at his own conveniency (taking care judiciously to mix, correct, and qualify the different sorts of tin which he takes in) melts the tin in a reverberatory furnace, with a fire of pit-coal, all which comes from Wales. The great consumption of wood used in charcoal by the former and more ancient method^b of melting tin by a *blowing-house*^c, suggested at last the necessity of introducing the pit-coal for this purpose, and among the rest to the noble Sir Bevil Granville of Stow in this County^d, who (as I have been informed) made several experiments for melting of tin therewith (though without success) in order to save wood, and keep the tin from wasting in the blast. The invention of the reverberatory furnace, about fifty years since, has rendered this fire effectual, but the pit-coal leaves a sulphureous brittleness in the metal which the wood-firc does not, the former assimilating in some measure the metal to the harshnes of stone, and the latter infusing the toughness of wood; and this is the reason that tin melted in the blowing-house by charcoal sells for more at the market (usually a twelfth part more) than that of the furnace, as being the purer metal. When the ore is sufficiently melted, it is poured into quadrangular troughs or moulds of stone, containing about three hundred and twenty pounds weight of metal^e, which, when hardened, is called a block of tin, and carried to the coinage town.

Of coining
tin. Five towns^m are appointed in the most convenient parts of the county for the tinners to bring their tin to every quarter of a year. In the time of Henry VIII. there were but two coinages in a year, viz. at Midsummer and Michaelmasⁿ, but two more were added at Christmas and Lady-day, for the conveniency of the tinners, for which they pay an acknowledgement (called Post-groats) of four-pence for every hundred of white tin then coined. When the tin is brought to the coinage-town, the officers appointed by the Duke of Cornwall assay it, by taking off a piece of one of the under corners of the block of about a pound weight, partly by cutting and partly by breaking; and, if well purified, stamp the face of the block with the impression of the seal of the Dutchy^o, which stamp

^b At present practised in some parts of Cornwall but only for small parcels.

^c Called so from a fire or blast perpetually kept in vigour by the blowing of a large bellows turned by a water wheel.

^d Temp. Car. I.

^e Formerly they made not these blocks so large, as appears by the blocks lately found in St. Austel-Moor mentioned pa. 163, which do not weigh full 30lb.

^m Liskeard, Loftwythel, Truro, Helston, and Penzance, which last was added to the four ancient Towns, in the time of Charles II. for the conve-

nieny of the Western tinners.

ⁿ Leland, Vol. iii. Itin. page 12.

^o The arms of Condurso last Earl of Cornwall of British blood (temp. W. I.) were Sab. 15 bezants (5, 4, 3, 2, 1) in pale, Or. See Camden, page 26. Richard King of the Romans, Earl of Cornwall, son to King John, threw these bezants into a bordure round the bearing of the Earls of Poiectou: He bore therefore Argent a Lyon Rampant Gul. crowned Or within a bordure fesse garnished by Bezants, (see Camden, page 27) and this still continues the Dutchy Seal.

is a permission for the owner to sell, and at the same time an assurance that the tin so marked has been purposely examined and found merchantable. The stamping of this impression by a hammer (in like manner as was anciently^p done to money to make it current) is called coining the tin. Every hundred of white tin so coined, pays to the Duke of Cornwall the sum of four shillings before the property can be disposed of, and this makes up a considerable annual revenue, much superior at present to what it was formerly. "The tin so sold (says Mr. Carew, p. 15) usually amounted heretofore to thirty or forty thousand pounds^q at twenty and thirty pounds a thousand, sometimes higher and sometimes lower;" but for some years last past, the price of each hundred weight of white tin has considerably advanced, and been from three pounds three shillings to three pounds eight shillings and six-pence, and the quantity sold has been much greater; so that the tin of the whole county, for fourteen years last past, has amounted, one year with another, nearly to the sum of 180000 pounds sterling; and for ten years last past by a particular account of the number of blocks coined in that time, and the price they sold at (though somewhat low for four years last past) I find that the whole tin of this county has, at a moderate computation, brought in cash, one year with the other, at least to the amount of one hundred and ninety thousand nine hundred and fifty-three pounds nineteen shillings and three-pence halfpenny. Of this the Duke of Cornwall receives (for his four shillings duty upon every hundred weight of white tin) above ten thousand pounds yearly; the bounders and proprietors of the soil may receive about one sixth at a medium clear, which we may reckon about thirty thousand pounds yearly; the remainder goes to the adventurers in the mine, who pay for all labour and materials, and may sometimes chance to be losers (as in every kind of merchandize is sometimes the case) but must always have the commendation and inward comfort of contributing in a great degree to the employment of the poor, to the enriching of their county, and to the increase of the public revenue.

If, together with the Cash which tin brings in clearly to the Lord of the Soil, procures as duties to the King by its mines, and to the Duke of Cornwall as tax upon every hundred weight of tin, we consider the several branches of employ which it creates for boys as well as men, carriage by cattle and shipping, the many handicrafts it promotes, and the trade for necessaries, which belong to mining, dressing, and melting, and all this out of a narrow slip of land usually of the most barren and hilly kind, without distressing the tillage,

^p Till the year 1553 when the coining mill was invented.

^q Yearly, as Mr. Norden, page 14, explains Mr. Carew's meaning.

pasture,

pasture, or fishery, tin must needs appear to be a great blessing to this county ; but indeed that part of it where the mines chance to be at present, *viz.* from St. Austel westwards, feels this advantage most sensibly, lands bringing a higher rent, the number of people being greater, and the markets much better stocked with buyers, than the eastern parts of the county where there are no mines.

S E C T. XIX.

Uses of tin.

The uses of tin are many : the ancients used it to make their mirroors, which served all the purposes of looking-glasses ; but to this consumption luxury put a stop (says Pliny) by introducing of silver : in other particulars their uses of this metal were much the same as those of the present age, though not so many. Tin is used in tinning bras and copper furniture of the kitchen, in soldering pipe and sheet-lead, in making of lattin, bell-metal, hard-wares, in lining of looking-glasses, in surgery, medicine, and painting, but above all in making pewter, which in some measure is used in all civilized nations, by every degree, from the poorest day-labourers to the prince upon the throne, there being hardly a house in Europe, or any part of the world where commerce reaches, but has some pewter : in all these particulars the consumption is as general as the use, and fresh demands and fresh supplies are perpetually quickening and urging on one another.

S E C T. XX.

Tin in general, its origine, conneξions, shape, and richnes.

Coeval to the creation.

Tin is the lightest of all metals, being reckoned nearly to water as 7321 to 1000¹; the softest of all metals, (lead only excepted) and the least fixed in fire ; it easily mixes with other metals, but imparts a brittleness to all ; *aqua regia* is its proper natural *menstruum*.

Tin in its natural state and hardest bed must, I should think, be reckoned coeval with the creation ; for it is found in bunches and spots in the granite, and the much harder stone of the Elvan kind, stones which can give no suspicion of their having ever been dissolved and reformed since the first induration of solids ; in laxer nidus's the particles of tin may have fluctuated and changed situations. It has been imagined that tin settled in such bunches by the percolation of waters charged with tin, but these bunches are frequently found in separate blocks of stone, open to day, and subject to no moisture but that of the heavens, and consequently to no percolation. Again : In percolation, either the texture of these stones would in a great measure resist the passage of the tin, or would freely permit it ; in the first case, we should find the tin condensed near the surface ; in the latter, find it funk and collected near the bottom ; but it is dispersed without any regard to either.

¹ But in the computation allowance should be made for the different purity of the weighed specimen.

Tin nearly approaches to silver in colour, but has so much more sulphur in it, that it quickly tarnishes in the air or moisture, and is really not so subject to hold silver as its sister lead, which is reckoned an inferior metal; but, besides the colour, it has several properties in common with silver, and frequent connexions with it; dissolved in strong acids it grows bitter as well as silver; fused with silver obstinately adheres to it, and resists lead almost as much as silver. Silver, though not of the purest kind, may be extracted from tin¹. In the neighbourhood of Oruro (a town in Peru famous for the mines near it) is the Colloquiri, which although a mine of tin, yet now and then in following the veins thereof, they meet with rich ores of silver, which they call Lipta².

Native tin, or tin found in the Cornish mines in a metallic state, Native tin. I am not certain that I ever saw; but March 21, 1747, viewing a rich piece of tin-ore from Bossehan in the parish of St. Just in a microscope, I thought I saw a small list of matured tin, white, shining like a thread of melted pewter; I then took a greater magnifier, and plainly perceived the same list; but intending to try further experiments to ascertain the truth, I could not afterwards find the specimen, and therefore do not assert the matter of fact. Agricola³ asserts, that this metal is no where found so pure as to be malleable; but the learned Dr. Grew (Musæum R. S. page 328) describes one specimen of "native tin lying as it were in bright drops in a brown stone," and I see no reason why tin may not possibly be refined, and the impurities of its *pabulum* separated by dis-solvent juices in the bowels of the earth, in like manner as copper is. Metals (as it seems to me) are only enshrined, more or less concealed, and wrapt up into ores by salts, sulphur, and stone, which are sometimes removed by a subtil *menstruum* in the earth. This is frequently the case of copper, sometimes of silver; and gold, the most perfect of metals, is still more frequently found in a metallic than any other state; but with tin this very rarely happens, by reason of the scarcity of its proper *menstruum*. Sea-salt (the basis of *aqua regia*) being the only salt we know which will operate on tin, disperse the impurities, and release the metal.

As white as tin is when melted, yet in the ore it is generally Tin crystals. black, and the crystals, which inclose the metal, are like black glafs. We have however some white, some cinereous, and some red tin grains, and some of a resinous colour, but they are rare, and I fear often thrown away by the heedless, although curious as well as profitable. *Stamping* and *dressing* do but pulverize and reduce the ore to smaller crystals, and the fordes which intervene

¹ See Boerh. Chem. by Shaw, page 97.
² Alonso Barba, page 92.

³ Page 421, see also Woodward's Cat. vol. I. class ii. part second.

being washed away, the crystalline parts, mixed with a flux proper to evaporate them, do not prevent the fusion of the metal inclosed. As to the shape of these crystals, tin is said to dispose them to the quadrilateral pyramid figure^{*}; but this is not all, Nature has given us a greater variety of figures, but mostly geometrical, straight-lined, and angular, so that indeed it is difficult to say which figure this metal covets most; this we may be sure of, that all metals vary the size as well as figure of their mineral granules in proportion to their own, and the power and quantity of the ingredients connected; thus, for instance, in the case before us, tin-ore shall be composed of crystal, salt, spar, sulphur, and metals and semi-metals more than one, of all which the figure shall partake, and be regulated, mixed, and qualified, according as the tin, which is the principal, is determined by the several subordinate concretions intermixed; nor let it be thought by the reader fanciful and unprecedented to take notice and exhibit here the several shapes of tin and other metallic shoots. The greatest Naturalists have not thought them unworthy their notice. Dr. Tancred Robinson observes in his M S. Itinerary of Italy (says Mr. Ray of the creation, page 94) the wonderful diversity of shapes and colours that oars and other fossils shoot into, resembling almost every thing in nature, for which it seems very difficult to him to assign any cause or principle; in the pyrites alone, he believes he himself may have seen, at home and abroad, above a hundred varieties." I shall therefore proceed in the same manner with all our fossils, as I have done with the mundic or pyrites before, (page 137, &c.), and set forth, in their natural size, the several shapes of tin-grains, or crystals inclosing tin, found in our Cornish mines.

The following figured tin-grains have occurred to me, and are exhibited in the annexed Plate.

Fig. 1. Is a compressed oblate pyramidal tin-grain of a resinous colour and texture.

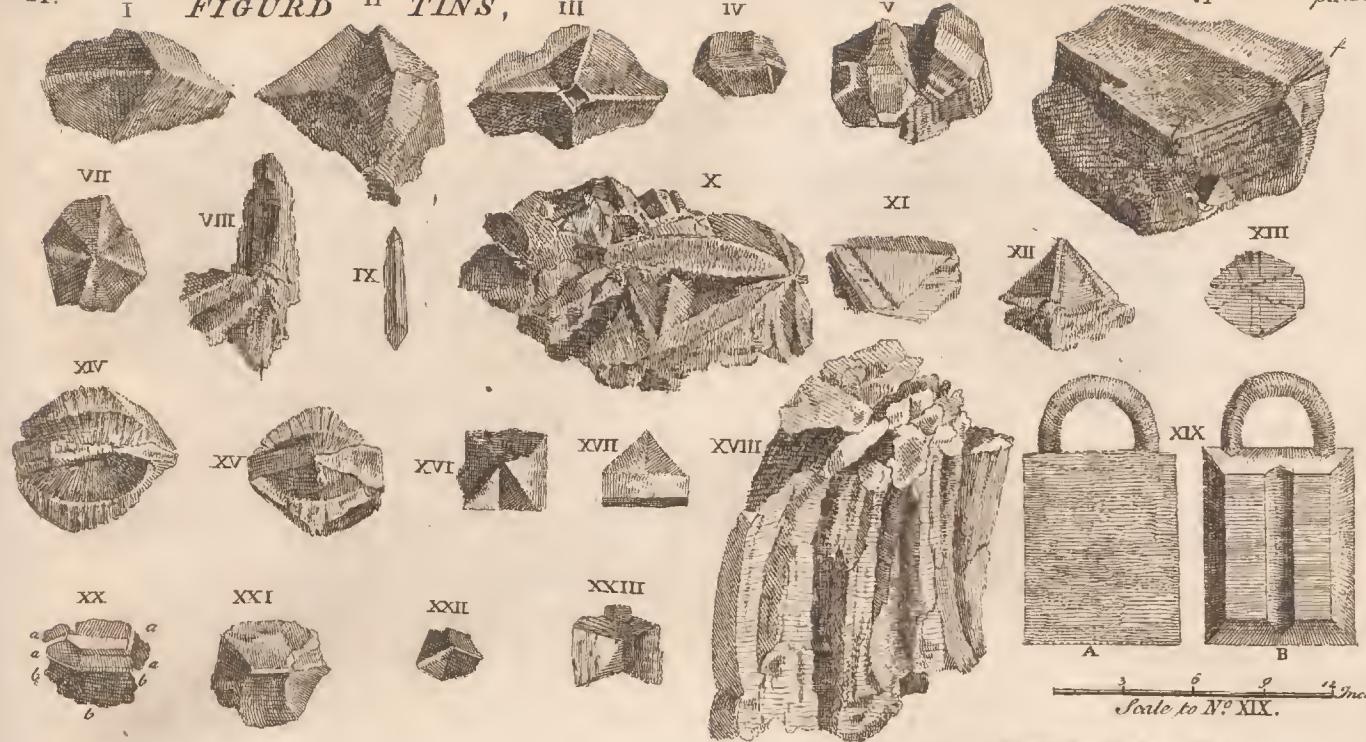
ii. Side-view of a black tin-grain indented in the centre.

iii. Front of the same, the apex towards the eye, with a perfect rhombus in the middle indented, regularly listed round the edges; from two angles of the rhombus, the list is only continued along two of the four ridges which diverge from the central point.

iv. Ten inclined planes, quadrangular, triangular, and hexagonal; black; composing all together one complete figured tin-grain.

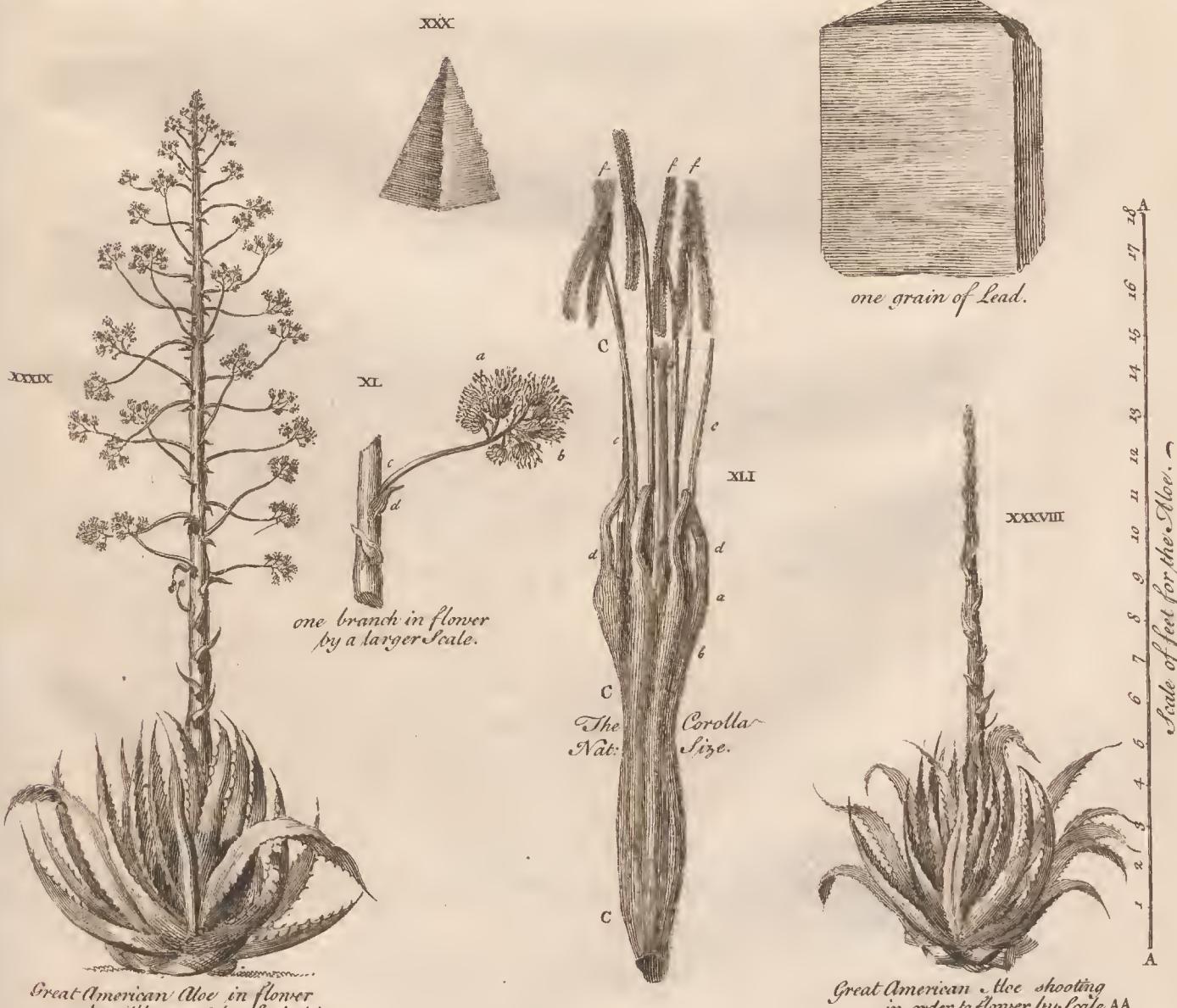
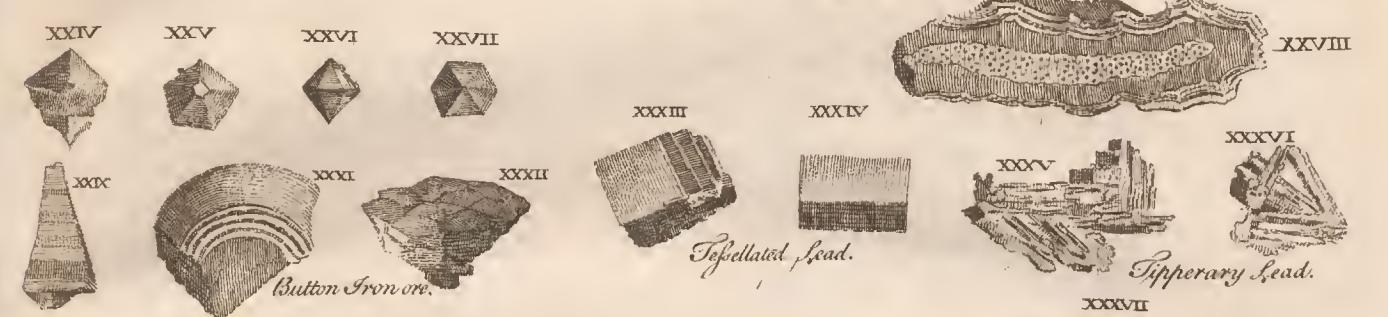
v. Irregularly quadrangular planes, the surfaces larger in the mid-

^{*} Woodward's Cat. vol. I. page 220.



Scale to N° XIX.

3 6 9 12 inches



Scale of feet for the Aloe. —

A
28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 A

Great American Aloe in flower
describ'd pa. 226, by Scale AA.

Great American Aloe shooting
in order to flower, by Scale AA.

To the Rev'd Charles Lyttelton L.L.D. Dean of Exeter and F.R.S. this Variety of
Tins and the American Aloe in blossom are inscrib'd with great respect by Wm. Borlase.



dle, and contracting gradually at each end; black, smooth, shining as glass.

Fig. vi. A very large grain of tin; the prismatic ridges in which this metal delights, are here placed nearly at right angles. It has a small rhomboid plane at the point of insertion where the ridges meet at *e*; but where the sides of the two ridges should meet, as at *ff*, they are there planed off. The largest tin-grain I have yet seen.

vii. The surface of this grain is divided into eight triangular planes, so applied to one another as to constitute four ridges meeting in a small central *fulcus*. This figure is very rare, and the planes of a high polish.

viii. A columnar grain on a rhomboidal base.

ix. D°. more distinct, the apex a quadrilateral pyramid.

x. A bunch of tin-grains, connected as if one large grain with its surface differently shot. The figures are pyramidal and cuneoid, three of the latter spread like the toes of a bird from the point of contact.

xi. An equilateral triangular plane projecting from a parallel ground, edged on one side with a quarter-round bead parallel to the adjoining side of the triangle.

xii. A pyramidal pentahedral grain perfectly smooth and black; its front consists of two unequal equilateral triangles, divided by a *fulcus*; of the other faces of the pyramid, two are cuneoid, the other circular.

xiii. Plan of the foregoing pyramid, N°. xii.

xiv. A quadrilateral, irregularly-pyramidal grain. The two ends are cuneoid, the two sides descend from the apex in a slope, striated to the bottom, where the *striae* spread off in an obtuse angle, as if designed to form another pyramidal process of like structure on each side.

xv. Another of like form, but more finished in figure, and of a higher polish.

xvi. A plan of a quadrangular pyramid on a column of a nearly square base; one face of the pyramid is divided into two nearly equal triangles by a subsidence in the middle, approaching somewhat to N°. vii.

xvii. The elevation of N°. xvi.

xviii. Grain-tin melted, first in the common way, then farther purified, as far as the present method will permit.

xix. A, the front, and B (by scale annexed) the back-view of an ancient block of tin, explained before, page 163.

xx. A curious grain of tin, black and shining, with *flamulæ* of a golden colour; the faces pentahedral; but the greatest rarity of this specimen

specimen is, that it is fixed on a base of a metallic hue at *a a*, *b b*, whose composition is micaceous, scaly, and soft, like burnt tin; it resists *aqua fortis*, and as it has the exterior of native tin, might possibly be mistaken for such, though meer talc.

Fig. xxii. A pentahedral pyramid of crystalline tin, the ridges and sides concave, with a slender rhomboidal, well-finished plane on the apex; it has many shining yellow *flammulæ* in it, and not improbably holds gold.

xxiii. A quadrilateral pyramid of tin, with a slender rhomboidal plane on one of the angles, with some sparks of yellow as before; but more resinous.

xxiv. A tin-grain extended like a book unfolding. These four last curious specimens came from Huel-fortune in Breag.

xxv. On a rhomboidal base two quadrilateral pyramids applied base to base.

xxvi. Two pentahedral pyramids joined base to base, each having a pentagonal cellule in the center of its apex. Both from St. Mewan Glebe.

xxvii. The side-view of two hexagonal pyramids of tin joined base to base.

xxviii. One of the pyramids with the apex in front.

xxix. Section at the fracture of a piece of tin in undulated ingrailed sheaths, nearly of an equal thickness throughout, inclosing one another; the central nucleus is base crystal.

xxx. A white pyramidal grain of tin with transverse belts of black.

Let it be observed, in the last place, that whatever the figure of these crystals is, this is the purest state of tin-ore, that ore producing most metal which has most of these grains and largest under any equal surface; and black-tin is no more than these crystals cleared of their impurities.

Rich tin-mines.

The richest tin-mine I have ever heard of, as to the quality of the ore, is one in the parish of St. Agnes, near the beacon, called Pol-berou. Several parallel and contiguous veins, mostly of large-grain crystals, make the treasure of tin in such quantity, that, in the year 1750, they could not get horses enough in the neighbourhood to carry the tin from the mine to the melting-house, but carried it in ploughs, a very unusual sight (though doubtless a more effectual and easy draught where the ways will admit of wheels.) Great part of the ore was so rich and pure that it needed not to be stamped, and the lode is so large that it affords vast rocks of tin: one rock, in March 1750, was brought to Killinick melting-house near

near Truro, which, as a clergyman present at the weighing informed me, weighed six hundred and sixty-four pounds, and it brought eleven and half for twenty, in the stone without stamping and dressing. I have since been informed, that one stone, brought to the melting-house from the same work, weighed 1200 pounds. It is judged that the late Mr. Donithorn, who had the whole adventure, and worked it at his sole expence, in a few years last past got at least forty thousand pounds clear by this mine, and much more tin he might have raised yearly if he pleased. It is a mine at present deep and wrought at a great expence by a water-wheel, bobs, and whims; but the lode is wide, rich in quality, and turns out great profit.

The mine which has turned out the most gain, and the greatest quantity of tin as yet known, is “*Polgoooth, in the parish of St. Mewan, where it appears by the old books, that the adventurers have got twenty thousand pounds annually for a great number of years following*”^x.

How far the Phenicians and Grecians interested themselves in SECT. XXI. the management of our mines, and whether, as is more probable, they were any other than the merchants to purchase and export our tin when raised, cannot be decided; but as it appears at present, from the testimony of Polybius, Strabo, Diod. Siculus, and Pliny, and others, that the Romans traded hither for tin, and improved the inhabitants in mining; so by their coins, sepulchres, and sacrificial instruments found in and near the ancient tin-works, (whither nothing perceivable could tempt them, but the riches of those mines^y) it is as apparent that the Romans worked those mines, or at least with their soldiers superintended the workmen. At this time the Britans had likely little or no property; they were the working miners under their conquerors, but what regulations they were subject to is uncertain.

The Saxons are said to have neglected the Cornish tin-mines; but indeed they had no authority in Cornwall till it was entirely conquered by Athelstan, after which they had no leisure, their attention was wholly taken up by the Danish wars; these wars at last prevailed, and the Danes soon after gave way to the Normans, and these last promoted the working of our mines to their great emolument. However, in the time of King John, I find the product of tin in this county very inconsiderable, the right of working for tin being as yet wholly in the King, (King John being at this time also Earl of Cornwall) the property of the tanners precarious and

^x Letter from Mr. W. Roswarn of Truro, Feb. 11, 1756.

^y See Antiq. of Cornwall, page 279.

unsettled, and what tin was raised, was engrossed and managed by the Jews to the great regret of the barons and their vassals. The tin-farm of Cornwall at this time amounted to no more than one hundred marks, according to which valuation the Bishop of Exeter received then in lieu of his tenth part, and still receives from the Duke of Cornwall annually the sum of six pounds thirteen shillings and four-pence², so low were the tin-profits then in Cornwall, whereas in Devonshire the tin was then set to farm for one hundred pounds yearly³. King John, sensible of the languishing state of this manufacture, granted the County of Cornwall some marks of his favour, disforested what part of it was then subject to the arbitrary forest-law, allowing it equal title to the laws of the kingdom with the other parts of England, and is said to have granted a charter to the tanners (Carew, page 17), but what it was does not appear.

In the time of his son Richard, King of the Romans and Earl of Cornwall, the Cornish mines were immensely rich, and the Jews being farmed out to him by his brother Henry III. what interest they had was at his disposal : at the same time the tin-mines in Spain were stopped from working by the Moors, and no tin being as yet discovered in Germany, Cornwall had all the trade of Europe for tin, and the Earl the almost sole profit of that trade. This Prince is said to have made several tin-laws ; but matters soon declining into disorder where the Prince has too much, and the subjects little or nothing, and the Jews being banished the kingdom in the eighteenth of Edward I. the mines were again neglected, for want of proper encouragement to labour, and security to enjoy and dispose of the products of that labour ; which the gentlemen of Blackmoor (Lords of seven tithings, best stored at that time with tin) perceiving (Carew, page 17), addressed themselves to Edmund Earl of Cornwall (son^b of Richard King of the Romans, &c.) and obtained from him, confirmed by his own seal^c, a charter with more explicit grants of the privileges of keeping a court of judicature, holding plea of all actions, (life, limb, and land excepted) of managing and deciding all stannary causes, of holding parliaments at their discretion, and of receiving, as their own due and property, the toll-tin, that is, one fifteenth of all tin raised. At this time also, as it seems to me, the rights of *bounding*, or dividing tin-grounds into separate portions for the encouragement of searching for tin, were either first appointed, or at least more regularly adjusted than before, so as that the labouring tinner might be encouraged to seek for tin by acquiring a property in the lands where he should discover it, and that the farm-tin acquired by the bounder,

^a Camden, page 5.

^a Ibid.

^b Not the brother, as in Gibson's Camden, p. 4.

^c Says Camden, page 4.

and the toll-tin, which was the Lord's share, might remain distinct and inviolated. What *bounds* are has been already mentioned, p. 167, the right granted in such bounds is now before us; and for the better promotion of tin-working in all waste and uninclosed grounds, every tinner had leave to place his labour in searching for tin; and when he had discovered tin, (after due notice given in the stannary court to the Lord of the soil, and formally registering the intended bounds without opposition or denial) he might, and at this time still may, mark out the ground in which he should chuse to pursue his discovery, by digging a small pit at each angle of such wasteral, which pits are called *bounds*; by this means he did acquire a right in all future workings of such grounds, either to work himself or set others to work upon his own terms, reserving to the Lord of the soil one fifteenth part of all tin raised therein. In Devonshire "the tanners constitution (says Mr. Carew, page 14) enables them to dig for tin in any man's ground inclosed or uninclosed, without licence, tribute, or satisfaction," which infraction of common property shews that the constitution of the stannaries was never equitably established in that county, as the same judicious author observes. These pits, all bounders, by themselves or others, are obliged to renew every year, by cutting the turf and cleaning up the dirt and rubbish which falls into them, to the intent that such landmarks may not be obliterated. In consideration of these privileges so granted by charter, the gentlemen tanners obliged themselves to pay unto Edmund and his successors Earls of Cornwall, the sum of four shillings for every hundred weight of white tin, a very high duty at the time it was laid on, the tanners of Devonshire then paying but eight pence for every hundred weight of tin; and that the payment of this tax might be the better secured, it was agreed, that all tin should be brought to places purposely appointed by the Prince, there weighed, coined, and kept, till the Earl of Cornwall's dues were paid. To this charter there was a seal with a pick-axe and shovel in saltire (says Carew, page 17), as he was informed by a gentleman who had seen this charter, though in Carew's time it was not extant.

In the thirty-third of Edward I. this charter of Edmund seems to have been confirmed, and the tanners of Cornwall were made a distinct body from those of Devonshire; whereas before, the tanners of both counties were accustomed to meet on Hengston Hill every seventh or eighth year to concert the common interest of both parties⁴. Two coinages yearly, *viz.* at Midsummer and Michaelmas, were also granted by this charter, and the tanners had the liberty

⁴ Camden, page 26.

of selling each man his own tin, unless the King insisted on buying it himself.

A farther explanation of the Cornish privileges and laws¹ was made by the fiftieth of Edward III. (Carew, page 17) and their liberties confirmed and enlarged by parliament in the eighth of Richard II. third of Edward IV. first of Edward VI. 1st and 2nd of Philip and Mary, and in the 2nd of Elizabeth*, and the whole society of the tanners of Cornwall, till then reckoned as one body², was divided into four parts, called from the places of the principal tin-workings of that time, Fawy-moor, Black-moor, Trewarnhey³, and Penwith. One general Warden was⁴ constituted to do justice in law and equity with an appeal from his decision to the Duke of Cornwall in Council only, or for want of a Duke of Cornwall to the crown.

The Lord-warden appoints a Vice-warden⁵ to determine all stannary disputes every month: he constitutes also four stewards (one for each of the four stannary precincts before-mentioned) who hold their courts every three weeks, and decide by juries of six persons with an appeal reserved to the Vice-warden, thence to the Lord-warden, thence finally to the Lords of the Prince's council.

Thus continued the tin establishment till the reign of Henry VII, when Arthur, eldest son of that King, and consequently Duke of Cornwall, made certain constitutions⁶ relating to the stannaries, which the tanners refused to observe, and indulging themselves in other irregularities not consistent with their charters, Henry VII, after his son Arthur's death, seized their charter as forfeited; but, upon proper submission, by his own new charter restored all their former privileges, and enlarged them with this honourable and important addition⁷, that no law, relating to the tanners, should be enacted without the consent of twenty-four gentlemen tanners, six to be chosen by a mayor and council in each of the stannary divisions. This charter was confirmed by the twentieth of Elizabeth, and (it being found inconvenient that the consent of the whole twenty-four should be required) it is declared at the meeting of every convocation or parliament of tanners, that the consent of sixteen stanators shall be sufficient to enact any law. Accordingly, when any more than ordinary difficulties occur, and either new laws for the better direction of the tanners and their affairs, or a more explicit declaration and enforcement of the old ones becomes necessary, the

¹ By the charter of Edmund therefore it seems as if there was but one coinage in a year, and the tinner could not sell without leave first obtained.

² Particularly recited in Plowden's Commentaries, page 327, Camden's Annotat. page 4.

* Pearce, page 49. ³ Camden, page 4.

⁴ Alias Tywarnail.

⁵ By these ancient charters (Carew 18); by Edward III. says Camden, page 5.

⁶ Not a Sub-warden over every company, as in Camden, page 5.

⁷ Camden, page ib.

⁸ By which charter [viz. of Pardon] he farther granted, says the editor of Camden, page 6.

Lord-

Lord-warden, by commission from the Duke of Cornwall, or from the Crown, if there be no Dukeⁿ, issues his precept to the four principal towns of the stannary districts, *viz.* Lanceston for Fawymoor, Lostwythiel for Black-moor, Truro for Trewarnhely, and Helston for Penwith. Each town chuses six members, and the twenty-four so chosen, called Stannators, constitute the parliament of tanners. In the reign of Elizabeth, Sir Walter Raleigh being Lord-warden, the tanners perceiving that by the charter of Henry VII. no law could be enacted, unless the full number of twenty-four stannators concurred *, proposed that twenty-four other stannators should be chosen, six at each of the tin-courts holden for each stannary, returned by the steward and added to the former number, in order to make forty-eight members; and that the majority of that number, or as many as should assemble of that number, should be enabled to make laws: This proposal did not take effect; but in the twenty-sixth of Charles II. 1674, some terms and claims insisted upon by the Crown meeting with great opposition, the stannators, being under difficulties, named to the then Vice-warden six persons for each stannary, and desired they might be summoned by the Vice-warden to meet and consult with that convocation †. Since that time it is usual, but not necessary, for every stannator to name an assistant, and the twenty-four assistants are a kind of standing council, and assemble in a different apartment, and are at hand to inform their principals of calculations, difficulties, and the state of things among the lower class of tanners, such as the stannators might not otherwise be so well acquainted with. The stannators, for the more orderly dispatch of business, chuse their speaker, and present him to the Lord-warden to be approved. Whatever is enacted by this body of tanners, must be signed by the stannators, the Lord-warden, (or his deputy, the Vice-warden who presides in his absence) and afterwards either by the Duke of Cornwall or the sovereign; and when thus passed, has all the authority, with regard to tin-affairs, of an act of the whole legislature.

The present Lord Warden is the Right Honourable Earl of Waldegrave.

Reverend Walter Borlase, L L. D. Vice-warden.

The present stannators of the tin-parliament, continued by adjournment and prorogation, are, for the

Stannary of Fawymoor,

Sir J. Molesworth of Pencarrow, Baronet.

Sir J. St. Aubyn of Clowance, Baronet.

ⁿ The eldest son of the King is Duke of Cornwall, without grant or investiture; but if this son dies, and leaves children, his eldest son cannot

be Duke of Cornwall without grant, but the title remains in the Crown.

* See page preceding. † Mr. Hawkins's MS.
D d d John

John Harris of Hayne, Esq;
 James Buller of Morval, Esq;
 Richard Vyvyan of Tresmarrow, Esq;
 John Sawle of Penrice, Esq;

Stannary of Black-moor,
 Honourable Richard Edgcumb Esq;
 George Hunt of Lanhydrok, Esq;
 William Trevanion of Caerhayes, Esq;
 Philip Rashleigh of Menabilly, Esq;
 Thomas Hawkins of Trewithen, Esq;
 Nicholas Kempe of Rossteag, Esq;

Stannary of Trewarnheyel,
 Honourable Edward Boscowen.
 Honourable John Boscowen.
 John Enys of Enys, Esq;
 William Lemon of Carclew, Esq;
 Richard Hussey of Truro, Esq;
 Reverend Thomas Hearle, A.M. Vicar of St. Mich. Penkevil.

Stannary of Penwith and Kerrier,
 Honourable George Boscowen, Esq;
 Robert Hoblyn of Nanwydn, Esq; speaker, deceased.
 Reverend Walter Borlase of Castlehornek. L L. D.
 Christopher Hawkins of Trewinard, Esq;
 Ed. Elliot of Port Elliot, Esq;
 John Rogers of Treaffo, Esq;

C H A P. XIV.

Of Iron found in Cornwall.

IN the reign of Queen Elizabeth there were no iron-mines, it is said, in all England^o, excepting Gloucestershire, and those not discovered many years before; but this was not for want of iron, neither could the discovery of these mines be the first, for we have undoubted proofs that the Romans wrought iron-mines in England, many Roman coins fresh and rough being found under large heaps of cinders which were, and are still, wrought over again for iron with good profit, the first melters having not sufficiently extracted the metal from the ore^p; and it now appears, that we have numbers of iron-lodes in several parts of England. There are many in

• See Dr. Musgraves Antiq. vol. I. page 156.

^p Walker's Dedication to his Account of coins.

Cornwall, as in working for tin we often find, and, by the great number of chalybeate springs, may justly infer¹; but not one that I have heard, or can learn, worked as yet to effect, although in some of them the ore is very rich, and near the surface. The truth is, the English iron-works are not only supplied with this ore in great plenty from the forest of Dean in Gloucestershire, but there are many rich iron lodes in Lancashire, Cheshire, Sussex, and Derbyshire, and other parts of England. In Staffordshire Dr. Plot (page 159) observes, that there is an iron-ore, called *Mush*, so rich and fusible that it may be made into iron in a common forge: in Wiltshire also they have an iron-ore of equal richness²; nay iron is not only found in lodes in many parts of the earth, but, when the lodes have been exhausted, the iron is in some places so collected and renewed from the neighbouring *strata*, (this metal being easily suspended, carried off, and deposited by common water) that a certain mine in Tuscany, after it is wrought out, becomes, in the space of three years, as pregnant with iron as it was before³. There being such an abundance of this most useful metal elsewhere, it is not likely that there will be any demand soon from other parts of this island for the iron-ore of Cornwall, neither can the Cornish entertain any reasonable hopes of manufacturing it in their own county, at least till wood for making charcoal becomes more plenty with them than it is likely to be for some generations; and if there were wood sufficient, it is no easy matter to set on a manufacture of this kind. This however is no sensible disadvantage to the county in general, our tin, copper, husbandry, and fish, with the necessary branches of trade dependant thereon, finding great employ as they are managed at present, and with some improvements (which might be easily introduced) would find still more; so that, till these resources fail, we shall be under no necessity of working our iron lodes; but it is worth our while, in the mean time, to acquaint ourselves with the nature of them better than perhaps we are at present informed; for if any iron lode is of a richness equal to that mentioned before, it may prove very profitable to the owner, even as matters now stand, especially if so near the sea that it may easily be exported coast-ways to Bristol and the river Severn, to which places ships are frequently obliged to go without lading. Again: In iron-mines a kind of ocre is often found, valuable according to the different degrees of its purity, and much used by painters; and if this happens to abound, it will well reward the miner for raising it, the best we have at present coming from France.

¹ Iron is found in the parishes of Morvah, Pi-ran-sand, Lanivet, Gwynear, St. Die, Temple, at the Lizherd-point, &c. Woodward's Cat. vol. II.

page 37—vol. I. page 232, &c.

² Grew's Mus. page 331.

³ Phil. Trans. 1740, page 89.

SECT. II. When iron forms by dropping from roofs and sides of caves, it becomes a lump of tubular parallel stems which hang side by side in the same manner as the mundics, Plate xvi. page 141, Figures xxxiv, xxxv. and copper, Plate xxi. Fig. ix. and is called Brush-ore. Sometimes it is found in the form and size of musket bullets^t, Plate xx. Fig. xxxi. page 186, each of which is fixed in its nidus, but never detached and perfectly globular, as far as I have yet seen. Dr. Grew (Mus. R. S. page 332) mentions iron balls made by the rolling of iron-sand off the banks among the iron-mines near Sen-neck, especially after rain; but these here are natural from the mine. Sometimes it is blistered into round tubercles, as Plate xv. Fig. ix. page 137, and Plate xxi. Fig. iii. at other times made into the exact shape of a button, protuberant in the middle, and declining on every side into a variety of polygonal planes, as Fig. xxxii. Plate xx. In both these last cases it is called the Button-ore. Iron is said to give the rhomboidal form to crystals^u: if this be true, it may also do the same to mundics; but, as the rhomboidal form is not peculiar to iron, the question will still remain undecided, whether one and the same mineral salt may not give this figure to them all, and be no more the proper consequence of iron than of the other fossils. This ore is sometimes found in Cornwall, near Truro, consisting of parallel plates which break into very shining and glossy surfaces^v, and a coarse false kind of iron-ore, called Kal, is found in most parts of Cornwall; this last promotes the fusion and toughness of tin, especially where mundic abounds; for the mundic by itself will scarce permit the tin in many places to be at all ductile: the truth is, the Kal connects the metallic parts, whereas the sulphurs of mundic have a quite contrary effect, and render them volatile.

C H A P. XV.

Of the Copper found in Cornwall.

THIS supple, rich, and useful metal, Cornwall has for some ages been reckoned to have been plentifully stocked with^w, but it has never turned out any considerable profit to the owners of the land till within these sixty years; so little does discovery signify, unless it be pursued with application, and knowledge how to make the proper advantage of it. At present it may be asserted

^t As in Huel-an-boys, in St. Just.^u Woodward's Cat. vol. I. page 220. Hill,
page 197.^w Woodward's Cat. vol. II. page 86.^x See Carew's Survey, page 7. Norden, page
9, 41, 42, 104.

with

with great security, that there is no richer copper, nor a greater variety of ores any where than in Cornwall.

Copper is found sometimes deposited on the sides of fissures in SECT. I. thin films, which are no more than the sediment of waters issuing from some copper lode; sometimes in spots and bunches irregularly dispersed, but mostly in fissures, in like manner as the tin-lodes.

In what state found.

Copper lodes throw from them few shodes, so that they are not often necessary to their own discovery; the reason of which is, that there is seldom any copper on the back of the lode, so as to constitute a *broil*; but when there is, and that copper is heavy, and promotes its own removal downwards by its gravity, copper lodes throw shodes as well as those of tin, of which several instances might be produced.

Veins of copper are oftentimes by the sedulous discovered in cliffs, where they are laid bare by the sea, copper being much easier discerned than tin. The most encouraging leader to copper is what the Cornish call Gossan, which is an earthy, ochrous stone, ruddy and crumbling, like the rust of iron. Where the ground is inclinable to an easy, free, blue killas, intermixed with white clay, the miners think it a promising symptom. A white crystalline stone is also reckoned very retentive of yellow copper. The ore does not lye at any one certain depth; but it is a general rule, that when copper is found in any lode, that lode should be sunk upon, it generally proving better at some depth, than when it is first touched.

That ore which is most common is of a yellow brafs-colour: it SECT. II. is found adhering to stones of all kinds, but purest commonly in the white opake crystal, or in the white clay, and according to the quantity of the barren stone intermixed, sells from five to fifteen pounds per ton. Of this yellow ore there are different sorts: some not only looks like mundic in texture, but is shaped into cubes (as the yellow mundic generally is) and will bear *aqua fortis* without stirring, and yet has been found to be real copper-ore, and worth eighteen pounds per ton; but the best sort of yellow is the flake-ore, called so from the closeness of its texture, which is as smooth and glossy as brafs, and not more porous: this sort is not so brittle as the former yellow, and has undergone the purification of a *menstruum*, being probably no more than the first-mentioned common yellow dissolved and deposited in the mine: it is found commonly in thin, visibly distinct, stratous masses, with its under parts of a blistered buttony surface, (Plate xxi. Fig. III.) according as the drops of the solution fell from different parts of the roof (Plate ib. Fig. II.). Where the solution is viscous and less diluted, it forms tubular sheaths

sheaths, one without another, like the stalactites, from the bigness of a thread to a cylinder of two inches diameter^y.

SECT. III. Of the green coppers, some are as light as a feather, being meer Green ore. *œrugo*, or verdigris^z; some more solid and stony, little metal in either; some a thick incrustation of a deep velvet green. One sample is very ponderous, (Fig. XIII. ib.) nothing of stone or rust appears, the texture consisting of small shining *striæ*, parallel, glossy as satin, extremely rare. It appears to be a solution of copper which distilled its glossy filaments upon a thin shell of the finest flake-ore, part of which caps this specimen still at *a*, *b*.

Of the green-coloured there is also a flaky kind of close contexture, sometimes cohering in tubes as it drops, (N°. XI. ibid.) but forming a richer, closer, and more polished surface still when it gets free (as Fig. X. XIV, XV.) which is perhaps one of the most curious productions of the copper kind. It is of two sorts, the rich, deep green, and the pale blue; the first much the more precious and best formed, prettily clouded, sets well in rings, but whether it may be reckoned a gem of the turcois kind, as has been already observed among the gems, page 116, I will not assert N°. X. came from Mr. Basset's work called the Pool*, the others, XIV, XV. from Lord Godolphin's mine in Ludgvan, called Huel-fortune.

SECT. IV. Besides the pale flaky blue mentioned above, I have likewise a Blue ore. blue earth of an extremely fine and small grit, but the greatest quantity I ever saw does not exceed the bigness of a bean: this curious earth is likely thrown away, because it appears in such little quantities as nature generally distributes her most precious gifts in. I have had it from two places, from the Pool, and the other, uncertain. Of the *lapis lazuli* I have never yet seen any found in a Cornish copper-mine, but this gritty blue is as it were the powder of it, and seems a kind of that precious stone incomplete, and not sufficiently hardened.

SECT. V. The grey-ore is often prettily spotted with yellow and purple, Grey ore. but the more of this mixture the less is its value. When it is of an uniform lead colour throughout, it is richest, and contains a great deal more metal than the yellow or green, being worth between fifty and sixty pounds *per ton*.

SECT. VI. Copper appears sometimes as a blue-black earth, of an indigo Black ore. colour, very light, interlaced with an opake base crystal. Mixed with

^y Fig^s. V, VI, VII, VIII, IX. XI. Pl. ib. p. 200.

according to the salts which produced them. Boerh.

^z These *œrugo's*, viewed in a microscope, appear to be clusters of crystals of various colours,

The. of Chem. Engl. page 88.

* Plate XVIII. page 169.

water it is a rich blue, but with nut or poppy oil it makes a deep ivory-black. Besides this black grit, there is a more solid kind of black copper-ore, very ponderous; it is blistered into large tubercles, by which it appears, that it is a solution of copper concreted in a bed of sulphur, and covered over with a glassy, sparkling crust^a: it may possibly be worth while for those who prepare paints by fire, to try whether some valuable blue colour, such as Prussian blue or *ultra-marine*, may not be extracted from the blue grit, Section iv, and those two black copper earths.

The red-ore mixed with glassy speckles (the crystallized salts of SECT. VII. this metal) is called the fire-ore; it rises generally in small, detached Red ore. glebes from a bed of coarse ochre, and the ferruginous *rubrica*, covered at times with a crust of lapideous green copper; some of it is a solution, as by the blistered granules appears; some the natural ore; it is very ponderous, and more valuable than any of the rest. Some ores of this colour break into shining surfaces, and resemble so much the ores of silver, that scarce any one can distinguish the largest grains of this sort from the *argentum rubrum* of Andreasberg in Hanover, which contains betwixt eighty and ninety parts of an hundred of silver, the waste flying off, being meer arsenick. This beautiful and rich ore is never saved separately from the rest, although it promises so fair for silver. It was supposed by some gentlemen at Leyden, to whom I sent a large specimen, close-grained and solid, that it contained much zink.

The most perfect copper, from which the before-mentioned are SECT. VIII. only so many inferiour and different removes, is the Malleable (from Malleable its purity called in Cornwall the Virgin-ore) which, in small quantities ore. at least, is found in all the most considerable copper-mines. It is variously combined and alloyed; some with base crystal (granulated) intermixed; some with goffan, some with white gravelly clay, some in ruddle and the rust of iron; in shape very various, sometimes thin spread, and shaped like leaves, now like drops and bosses, now branched, fringed, or twisted into wires, in hollow filagree, in blades and daggers, now in powder little inferiour in lustre to that of gold; sometimes blistered, at other times a congeries of combined granules; but which is the finest of all, sometimes in solid lumps (as the Mullion copper) of several pounds weight, matured, unmixed, and highly polished.

Fig. i. Virgin-ore, somewhat blistered; it has several little co- SECT. IX. lumns at *a*, crossing each other like bones, with knobs or bunches

Explanation of
the figured cop-
pers, Plate xxii.

* A very rare specimen from the Pool.

at

at their ends : at their intersections they make unequal angles, and therefore could not be of the stalactite kind. Its colour is like manufactured copper before it is polished.

Fig. II. The upper face of a flaky brass-coloured specimen ; its surface beset with circular *laminæ* growing less towards the top, shewing that drops of this metal falling from above, were at first large, and spread into the broadest *laminæ* ; a smaller drop succeeded, and falling on the same centre, hardened into a lesser circle, and so on, the circles being as many as there were drops. Some have five *laminæ* on one another, as *b*, *c* ; others two, three, and four, large in proportion, and in number equal to the drops which fell. This rare specimen shews how the flaky ore is formed, namely, by distillation. *N. B.* The under part is blistered into large tubercles, as in the following sample.

III. The bottom of flake-ore blistered by distilling into a soft bed, (likely of sulphur) each drop making a convexity.

IV. Brass-coloured flake-copper, small-blistered, depressed on the surface into five concave cells, divided by plain partitions.

V. Brass-coloured, powdered with blue earth, the top divided into two cylinders, below which, from a wreathed edge, the filaments are perpendicular, in the fungite manner.

VI. Brass-coloured ; the filaments coursing transversely at right angles with one another ; it is powdered with a blue little inferior to the *ultra-marine*.

VII. A conic cluster of wreathed threads, brass-coloured, curiously interlaced, in some parts detached from the main body like hollow carved-work, incrusted with a beautiful cinereous film, the surface rather of a fine grit than smooth and glossy.

VIII. An hexagonal tube of flake-copper, its perforation filled with the same solution, girt round with a continued bandage of blistered flake-ore.

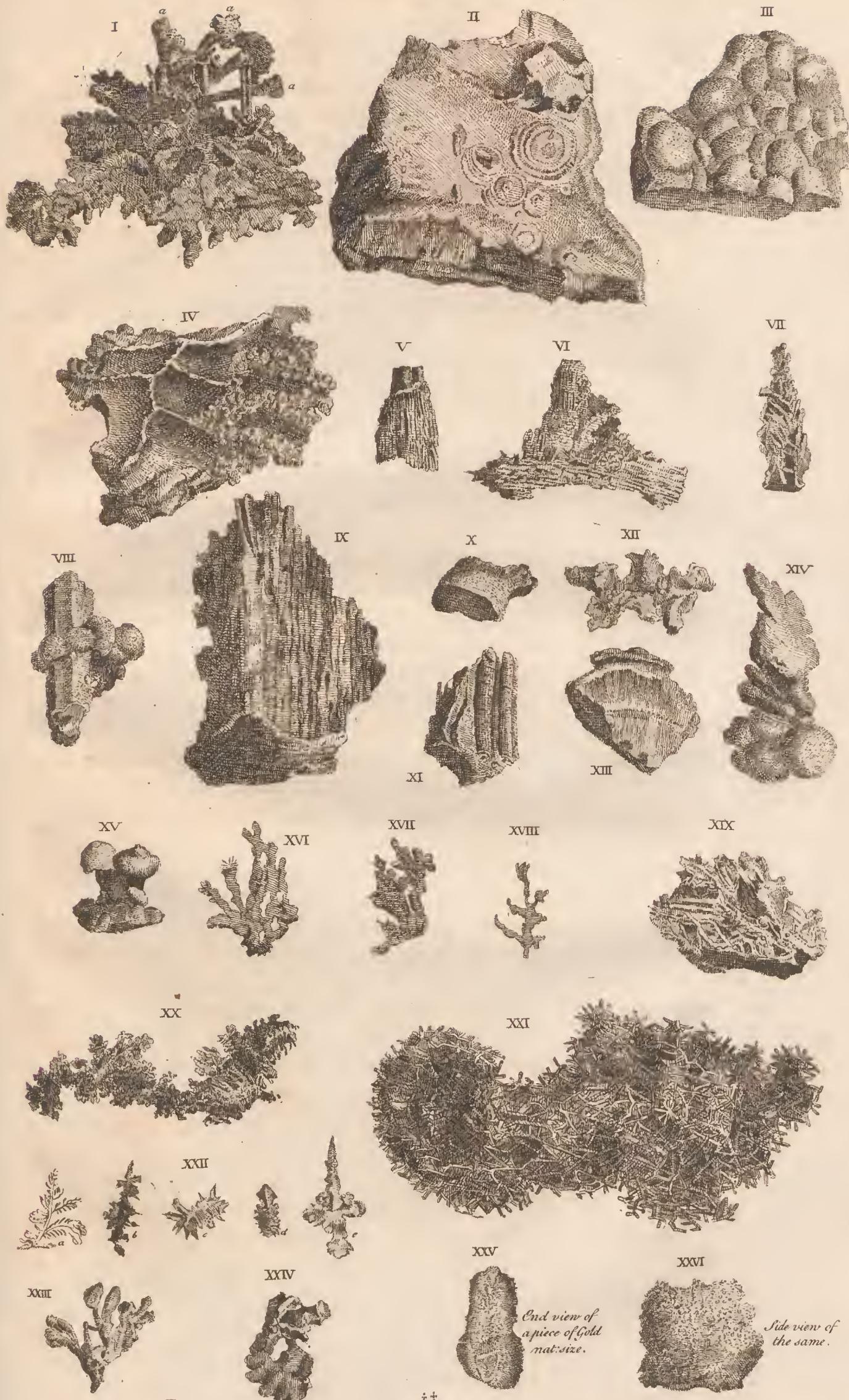
IX. Brush copper-ore, in parallel tubes, of a dusky brown colour.

X. A solid piece of the finest green ; its texture consisting of different *strata* of greens, large blistered, probably the *malachites* of authors.

XI. Less solid green, of a glossy coating, formed into tubes, braced with vermicular rings like the joints of a caterpillar ; the outer tubes have an inner one inclosed, the perforation small as the point of a needle.

XII. Solid, glossy, green, branchy.

XIII. Green ; the filaments as fine and glossy as the pile of velvet, armed with a thin shell of blistered flake-ore, on which are formed three parallel circular determinations of the descending *striæ*.



To the Right Rev. George Savington, Lord Bishop of Exeter; this variety of
Coppers is with great duty & respect inscribed by Wm: Borlase.

Fig. xiv. The smooth, solid, high-blistered copper, (section III. page 198) from Huél-fortunc in Ludgyan, the most pure and beautiful of the green kind.

xv. The same sort, mamillary with a drop at the bottom, formed probably in a pendulous position.

xvi. Virgin leaf-copper, branchy.

xvii. Ditto.

xviii. Ditto.

xix. Virgin-ore branched, and fibrous like the anatomy of a leaf.

xx. Virgin-ore, fringed at the edges.

xxi. This elegant specimen of virgin-ore run into hollow filagree, consisting entirely of so many branchy filaments, terminating in little astroite tufts, and the ends of the branches tipped with *papillæ*, all of pure copper, came from the Tolvaen copper-work in the parish of St. Just, Penwith, 1754^b.

xxii. Brightest virgin-ore shot into daggers, *cuspides*, branches, and sprigs, as *a*, *b*, *c*, *d*, *e*.

xxiii. The purest virgin-ore from Mullion formed into drops.

xxiv. D°. spread into regular leaves, and bunchy.

The two last specimens are of the richest, most sparkling, and best naturally polished copper-ore which any mine affords; some years since it was raised in the parish of Mullion in large lumps of several pounds weight, one lump of it weighing forty pounds: what heightens the beauty of this ore is this, that in most places it is enamelled with that green flaky *aerugo*, which age alone gives to coins and medals, and art in vain endeavours to imitate.

Copper covets not geometrical or angular figures.

It may seem a little surprizing that we should find copper native SECT. X. and malleable so much more frequently than any other metal, and Why malleable copper, in such a variety of colours and shapes. The reason is this: Copper in the mine is more easily dissolved and stripped of its stony *involutrum* than any other metal: it is soluble by all the salts known, and of so many sorts from the mine. both acid, alkaline, and nitrous^c, nay even by common water, and in some states by the air itself. What makes it yield so to almost every fluid, is, that there is little stone, but much vitriol incorporated with copper; and vitriol, being no other than a free soluble salt, is always ready to mix with every kind of moisture which attempts it. Hence it comes to pass, that copper is frequently liquified in the earth, and every time the vitriol melts, and becomes suspended, the incorporated copper deserts its *primæval* bed of stone, and when it becomes too heavy to be born along by the fluid vehicle, distills from

^b This seems to be what the Spaniards in their Peruvian mines call Machacado. Alonso Barba,

page 85.

^c Boerh. page 88.

higher into lower parts of the mine, sticks in tubes side by side, or forms into thin leaves or fringes in the chinks of the rock, floats into horizontal *laminæ* on plane surfaces, or is detained and formed by the hollows which it swims into.

Let it be observed in the next place, that when the *menstruum* is different, the solution of copper will be so too, and will be more or less pure according to the quality and power of that *menstruum*. If iron (which is a magnet to copper) interferes, the vitriolic fluid deposites the copper, and mostly in granules, corroding at the same time, imbibing and carrying off the iron, by which it is attracted more forcibly than by the copper. Again: There being so many *menstrua*, and the concretions of copper so soluble, the metal must undergo sometimes a great many solutions in the mine; and as every dissolution must deposit some *fæces*, the metallic glebe consequently becomes proportionably the more pure the oftner it is dissolved. This observation may lead us to account for the different states and degrees of purity which we find in the solutions of copper above-mentioned. The yellow, flake, brass-coloured copper, (Section II.) is a solution, as appears not only from its frequently blistered bottom, as Fig. III. Plate xxi. but also for that the plain signs of the drops, as they fell and concreted on each other, are evidently to be seen at *b*, *c*, in Fig. II. ibid; but by reason either that the *menstruum* was not forcible enough, or that this and such like was the primary and only solution, these specimens have neither the ductility, nor colour, nor weight of the malleable ore; they retain more of the arsenical sulphureous state of the common yellow ore, and are indeed but one remove from it. In other solutions, as particularly in the red blistered ore, we find a further degree of purification, owing to a more powerful *menstruum* or reiterated solution, or both, till at last the metal becomes thoroughly matured, that is, as ductile, and free from stone, sulphur, and salt, and as brilliant in colour, as fire itself can make it, which indeed is the case of the Mullion copper*. Again: The different *menstrua* not only defecate the ores of copper, but also impart various colours to them. Acids will make copper green, *alcalies* will make it red, *sal armoniac* and the intermediate salts will give it a blue cast⁴. These *menstrua* again being reduced and qualified by one another, will give it the grey, black, and purple dyes, whence arises the great variety of colours so conspicuous in these ores; but when the *menstrua* are clear and forcible, they borrow from the copper, and impart the most piercing dyes to precious stones, making the *lapis lazuli*, the sapphire, emerald, amethyst, beryl, and other gems.

* Sect. VIII. page 199.

⁴ History of Waterford, page 304.

As to the mining part, copper-works do not differ from those of SECT. XI. tin materially, but the method of dressing or preparing the metal ^{of raising, sorting, and} for sale is very different. To separate the good ore from the bad ^{dressing the} with greater advantage, certain overseers ^{copper ore.} are appointed to superintend the labouring miners, and see that all the richer sorts of ores be kept together in the bottom, then raised as unmixed as may be, and laid forth on the grass in distinct heaps; and because there will be some waste in breaking, the ore is taken out of the lode, and brought to grass in as large lumps as the tackle of the engine will muster^f. What comes from the people below, is reexamined as soon as it arrives at the mouth of the shaft; the best is broken small with hammers, which they call Spalling, or brought away to the adjacent bucking mills, where there are men ready to bruise it upon a rock with a short bar of iron, and thence carried to the heap of best ore, and what is not worthy of the first place, is laid by to make another sortment; the best small ore (which consists of the smaller fragments of what has been broken and sorted before) is then washed and sifted into a tub or kieve as near to the shaft as possible (to prevent waste), first through an iron sieve or searce, called in Cornwall the Griddel, the meshes about half inch square; here the waste, or barren stone, by washing is discovered and thrown away, and what has copper in it sorted into *best*, and *dredged*, (that is, streaked, spotted, powdered ore, which requires a second washing) and the larger pieces of ore of each sortment are thus divided; what passes through the griddle, is taken up out of the kieve, and put through another searce of smaller mesh, called the *jigging* searce, which has eight holes in every square inch; here, when it has been lifted up and down, and turned round in the searce a few times (which they call *jigging*), the waste will all rise to the top, and settle in the middle like small sand, and what remains underneath will be clean ore. The poorer sort, which is the streaked or dredged ore, is carried from the mine to the next adjoining stream of water, where in several pits made for that purpose, called the *strakes*, it is washed clean; all the richest bits of ore are then culled from the rest by girls or boys at the hire of four-pence *per* day, and the poorest or most stony parts, which are not fit to be put with the picked ore, are carried to a stamping-mill, there pounded, and passed through a rough grate^g; what ore rests in the forepart of the pit, F, Fig. III. Plate xix. is carried back to the *jigging* searce and worked as before-mentioned; but what runs off to the hinder-

^e Called Under-ground Captains.

^f July 12, 1743, I saw a large rock of copper taken out of a lode in Clowance wood, which weighed 1275 pounds weight: they endeavoured

to raise it entire by the *whim*, but the beam breaking, the rock also broke in two parts, and the pieces were then brought up.

^g See stamping of tin, ch. xv. sect. xvii. p. 178.

most part of the pit, F, and remains there, and in the second pit, G, is slimy, and must be *trunked*, *buddled*, and *tozed*, as the slimy tin^h.

This is the present method of dressing copper, which employs many hands; and yet in works which throw up a quantity of ore, it is all broken, raised, sized, washed, picked, stamped, and sorted into particular heaps for one tenth part of the whole produce when sold, and sometimes for less.

SECT. XII. A quantity being sorted, cleaned, and divided into heaps, accord-

Method of selling copper in Corn-wall. ing to the quality of the ores, the agents for the copper-companies of Wales and Bristol (who reside at Truro and Redruth) upon notice given,

attend to *sample* the ore, and each sampler having taken from each pile as much as is sufficient for assaying and ascertaining the value of that pile, a day is appointed by joint consent of the seller and buyer, at such distance as may give the sampler time to repeat and verify his assays, for the sale of the copper: on the fixed day each of the samplers attends, and produces a ticket, or written paper, sealed up, in which is expressed the price which each sampler will give for the ore: he, who in his ticket bids most, has the oreⁱ. This way of selling has obtained about thirty years, and must be a very fair way of dealing provided the agents do not in concert consult one another's convenience in buying (which perhaps is no more than every buyer thinks he has a right to do) rather than the just value of the ore; provided also, that they do not divide the parcels occasionally, so as that no buyer may have reason to complain, and remonstrate; that they do not groundlessly suggest an exorbitant fall of the price of copper which the owner cannot contradict; provided also, that these agents do not combine to distress and reduce the copper of a reluctant and too inquisitive miner. Such complaints are muttered, but with what grounds I pretend not to decide. If, besides this, the agents for the companies should combine, and refuse to admit the tickets of any person whatever, who had a mind to offer for any parcel of copper, it would justly increase and give weight to these suspicions: neither can these companies blame the present generation, if they be somewhat uneasy; people who have wares to sell, of which they know not the value, (which is the case of the owners for the most part) have been suspicious in all ages of their being imposed upon at the time of sale: this is no where more evident than in the case before us. My business is history, not traffic, and I shall meddle with the

^h See before, pages 178, 179.

ⁱ It must here be observed, that if the assayer offers only according to the product of his assay, he offers much short of the real price, "it being

well known from the laws of attraction, that a large portion of ore will yield more in proportion than a smaller quantity." See Smith's state of the county of Kerry.

latter no further than is necessary to illustrate the former. The richness of our copper-works is not a late discovery, but indeed the application of the Cornish to work them effectually, is not so old as the present generation; the reason most obvious is, that those who best knew the value of these mines, made it a part of their trade to conceal it. Mr. Carew (in the reign of Elizabeth) hints at the little profits made in Cornwall from copper, and assigns them to the searcher's being kept in ignorance by the merchant. "Copper is found, says he, (page 7, first edition) in sundrie places; but to what gain to the searchers, I have not been curious to enquire, nor they hasty to reveal: for of one mine, of which I took view, the ore was shipped to be refined in Wales, either to save cost in the fewel, or to conceal the profit." Mr. Norden, 150 years since, seems to have had full information that the Cornish copper-mines were rich, and therefore in his letter to King James I^k. like a faithful servant, (surveyor as he was to the then Prince of Wales) intimates the expediency of a better inspection into the state of those mines, and surmises the arts by which the value of them was concealed. "So rich are the works (says he, *ibid.*), especially some lately found, as by the opinion of the skilful in the mistery the like have not been elsewhere found, though the worth hath been formerly extenuated by private pryers into the secret, and covertly followed for their own gain." Notwithstanding these hints, I do not find any thing material going on here in Cornwall, as to the improvement of the copper-mines, till, about sixty years since, some gentlemen of Bristol made it their busines to inspect our mines more narrowly, and bought the copper raised for two pounds ten shillings *per ton*^l, and scarce ever more than for four pounds *per ton*. It must be observed, that the yellow ore, which now sells for a price between ten and twenty pounds *per ton*, was at this time called *poder*, (that is, dust) and thrown away as mundic. The gains were answerable to their sagacity and diligence, and so great, that they could not long be kept secret; this encouraged other gentlemen of Bristol, about forty years since, not only to buy copper at a low rate^m, but to engage as adventurers in some old mines; and at this time Mr. John Costar, a gentleman well skilled in metals, judicious, and particularly knowing in mechanics and hydraulics, undertook, by means of a water-engine, (either of his own invention, or at least improvement) to drain some considerable mines with success: he taught the people of Cornwall also a better way of assaying and dressing the ore.

^k See Norden's Survey of Cornwall, page 104.

^l At N'uun-vian in Piranuthno, and at Mr. Ustick's works in St. Just.

^m Mr. Beauchamp of Gwenap at this time co-

venanted to sell all the copper which should rise out of a mine well stocked, for twenty years, at five pounds *per ton*, and the ore at Relistian in Gwinear was covenanted for at two pounds ten shillings *per ton*.

Here may we date the advance of the price of copper and improvement of copper-mines ; for though this gentleman was frequently purchaser of the whole product, as well as director of all the mining part, (as indeed he well deserved to be) and by this means could the better, and not unjustly, conceal his profits ; yet the copper could not be sorted, dressed, and weighed, and sometimes separately sold, without the real value transpiring in some measure. By degrees the Cornish dressers of copper-ore grew informed nearly of the value and proper management of the ore, and at present a great many assay it.

The copper being thus sold to the agents of the copper-companies in Wales and Bristol, is shipped off for those places to be melted and refined.

SECT. XIII. The first and greatest copper-mines which have turned out considerable profits within these forty years, are the following :

Mines and their revenues yet im-
proveable.

Chace-water, in the parish of Kenwyn (*a*) ; North Downs, in Reddruth (*b*) ; Huel-rôs, in St. Agnes (*c*) ; Roskaer and Huel-kitty, in Camborn (*d*) ; Huel-fortune, in Ludgvan (*e*) ; the Pool, in Illogan (*f*) ; Dalcooth, Bullen-garden, Entral, Longclose, in Camborn (*g*) ; Metal works, in Gwenap (*h*) ; Trejeuvyan, in Gwenap (*i*) ; Binner Downs and Clowance Downs, in Crowan (*k*) ; Huel-cock and Rosmoran, in St. Just (*l*) ; and Herland mine, in Gwinear * : But the greatest and most sudden gain produced by any copper-work which I have yet heard off, and as far as the memory of man reaches, was that of Huel-virgin, in the parish of Gwenap, in July and August 1757. In the first fortnight's working, it threw up copper sold for five thousand seven hundred pounds ; in the next three weeks and two days, as much copper as sold for nine thousand six hundred pounds : to raise the first-mentioned quantity, it cost the adventurers no more than one hundred pounds ; to raise the second, a trifle more in proportion to the quantity.

All these either are or have been of late years very profitable works ; and besides the many thousand pounds annually returned to the Lords, (their dues being generally one fifth part of the whole produce clear of all expence, never less than one eighth clear) great fortunes have been raised to adventurers, and there are several other gainful though less considerable mines now in working, so that the annual income to the county from copper equals very nearly at

Lords of the Soil are

- | | |
|--|---|
| (<i>a</i>) Lord Viscount Falmouth. | Esq; Mr. Abel Angove. |
| (<i>b</i>) Sir John St. Aubyn, Baronet, and John Nance, Esq; | (<i>g</i>) Francis Bassett, Esq; |
| (<i>c</i>) Thomas Heyes, Esq; | (<i>h</i>) Francis Beauchamp, Esq; |
| (<i>d</i>) Samuel Percival, Esq; late Sir William Pendarves, Knight. | (<i>i</i>) Hugh Rogers, Esq; |
| (<i>e</i>) Earl of Godolphin. | (<i>k</i>) Sir J. St. Aubyn, Baronet. |
| (<i>f</i>) Francis Bassett, Esq; H. Mackworth Praed | (<i>l</i>) J. Utstick, Esq; |
- * James Buller, Esq; the late Robert Hoblyn, Esq; Mr. Abel Angove.

present

present that of tin, it being computedⁿ that, for fourteen years last past, the copper of this county has produced cash, one year with the other, to the amount of one hundred and sixty thousand pounds. This is a happy addition made within these forty or fifty years to the employ and revenue of this county ; and what the Cornish gentlemen have now to consider is, whether both may not easily be still improved.

The water, in which they wash their copper ore, has been SECT. XIV.
lately experienced by an ingenious foreigner^o to make as good blue
vitriol as any in the world, which appears from the vitriol manufacture
lately carried on at Redruth ; but there is still another, and more
profitable use to be made of the same. The water which comes
from the bottom of the mine, is now suffered to run off in waste
through the adit, whereas it is so strongly impregnated with copper,
that if, together with the water in which they *griddle*, *jig*, *stamp*,
and *buddle* the ore, it was collected carefully, and detained in pro-
per receptacles and pits, old pieces of iron might be immersed in
these pits to great advantage, and thereby a quantity of malleable
copper might be obtained without hazard or attendance, or other
cost than that of the most useless old iron. When the water is
strongly impregnated, the exchange is usually quick, and performed
in fourteen days ; but if a much larger space of time was required, the
demurrage will be well requited. The experiment has been tried by
W. Lemon, Esq; of Truro, and with success : I have also a specimen
of ore precipitated in the copper-mine of Trewan in St. Agnes, and
there is scarce any copper-mine but will have the same effect ; and
the gain may be estimated in some measure by a calculation made
at the copper-mines of Arklow in Ireland, where “ one ton of iron-
bars immersed in the adit in twelve months time produces one ton
and nineteen hundred and a half weight of copper-mud, or dust ;
now, each ton weight of mud, when melted, produced sixteen
hundred weight of the purest copper, selling at ten pounds *per ton*
more than the copper made of the ore^p. In these mines the pro-
prietors had at one time five hundred tons of iron, and might with
proportionable advantage have laid in as many thousands. The
softest iron is best ; the pits ten feet long, four wide, and eight deep ;
the sides faced up with stone and lime, with wooden beams across
the pits to rest the iron bars upon : chains of these pits are contin-
ued along the stream as far as the directors please, for the water
never abates its quality^q.” It is not every stream which comes from

Matte's worthy
of farther con-
deration relating
to the copper-
business in Corn-
wall, suggested
to the Lords and
Miners.

ⁿ Letter from William Lemon, Esq; to the au-
thor, January 12, 1758.

^o Mr. Rouby of Plymouth.

^p Philosophical Transactions for 1752, page
502.

^q Ibid.

a copper lode that will produce such a surprizing quantity of copper, and in Cornwall, where we have so much water usually in the bottoms of our mines, the cupreous particles may in many places be too much diluted to yield the above-mentioned great return, but it is not to be questioned that the experiment will answer, under proper directions, in a great many adits, especially where one drift or adit serves as a drain to many workings.

Another point worthy of consideration is this; "that copper grows in the same places with gold and silver, and oftentimes, in following a vein of pure copper, they have met with a nest of the finest gold; but it is more usual to have its veins change into silver". "The mine of Osloquee, in the Lipes of Peru, was at the top in a manner all copper, and every spade's depth, as they dug downwards, the ore grew more rich in silver, untill in the bottom it became all pure silver;" and in a copper-mine called Huel-cock, in the parish of St. Just, native silver has been found among the copper ore, and it would be very wonderful if this mine should be the only one which afforded an instance of this kind among such a number of mines as we have, and some much richer than this.

That the glassy red has a great affinity to the silver ores has been mentioned before, and it is not improbable but some of our ores may contain gold as well as silver. Copper-mines have also quicksilver oftentimes in their lodes, and in Hungary it is thought strange when the *Herenground* mines are ever without it. Now in Cornwall the proprietors, generally speaking, do not know the quality of the plainest copper, much less the nature of the richest: they take the word, as well as the money of the buyer implicitly; nor are they at liberty, by the present rules of commerce, to insist upon any assay they have made of their own ores, or postpone the sale to a better offer. This matter might possibly be put upon a more satisfactory as well as equitable footing, in case an assay-office was established for every owner to have recourse to, and ascertain in some degree the value of his ore before he treats with the agents of the company; but better still, and more likely would it be to bring the ore to a just value, if melting-houses were erected for refining copper in the same manner as there are for tin. This would employ an additional number of hands, and every new employ is of service to the county in proportion to the number employed: this would also leave the seller at liberty to frequent that melting-house which offered most kindly for his ore. It is objected, that the expence of importing coals from Wales for melting copper, will never permit such a scheme to take place. Whether this be matter of fact or not, is at present

* Sir Hum. Mackworth of the mines, page 151.

Alonso Barba, page 83.

under examination, several gentlemen having concurred to set up furnaces for melting and refining copper-ore in Cornwall, and to the success of the experiment, without entering into the dispute, I refer it.

C H A P. XVIII.

Of Silver, Lead, and Quicksilver found in Cornwall.

IT is reported that Edward I. and Edward III. reaped consider- SECT. I.
able benefit from the silver found in these parts, since which ^{Of silver.} several gentlemen have searched for the same metal at several times, but without success¹; and in the sixteenth century, one Mr. Bur- chard Craneigh, a German, seems to have had the direction of some mines carried on to raise this valuable metal; he set up a refining- house also in the hundred of West some little time before Mr. Carew's writing, though with small advantage². Silver found in Cornwall by itself, unmixed, (I mean, free from tin, copper or lead,) I have never seen but once, and that was found native, about the bigness of a walnut, (of which I have part,) in Huel-cock, a copper-work in the Parish of St. Just. It is indeed seldom that silver is found any where native³; 'tis generally so intermixed with stone, that it is not to be known but by men of experience⁴: 'tis usually mixed also with other metals, tho' oftenest in a kind of black stony glebe, full of shining streaks: it has a corrosive sulphur or bitumen always attending it⁵. What may be mixed with the ore of copper has been hinted already in the foregoing page; and if any unknown ore fuses and runs before it ignites, it is most probably silver, and merits farther enquiry⁶.

Lead and tin were anciently⁷ reckoned only two different states SECT. II.
of one and the same metal. Tin was called the *Plumbum album*, Of lead.
and esteemed the purest; and what we call Lead, was the *Plum- bum nigrum*: but if these were really but two sorts of one metal, as not only the ancients but some moderns⁸ have thought, then there would be different and intermediate states of purity and weight, whereas we find lead always of the same determinate weight, lead being to water as 11345 to 1000, and tin always as 7321 to

¹ Carew, page 7.

² Ibid. page 130.

³ Some surprizing instances however there are of this kind in the Norway silver-mines. In the Royal Museum at Copenhagen, there is preserved a piece of native silver five hundred and sixty pounds weight, another piece two hundred and sevnty-nine pounds weight, another two hundred

and forty-five, and a fourth three hundred and forty pounds weight. Pontop. part I. English, page 188.

⁴ Alonso Barba, page 77, 78.

⁵ Boyle's Hydrost. balance.

⁶ Boyle ut supr.

⁷ Plin. lib. xxxiv. chap. xvi.

⁸ Clerk's Phys. page 136.

1000, or as $7 \frac{3}{4}$ to 1^c: Besides, lead will dissolve in acids, but tin, like gold, in *aqua regia* only. Lead therefore and tin are two metals radically distinct, each constant to its own peculiar specific weight, and requiring a different *menstruum* from the other. Lead is of great use, not only in sheets, pipes, or more solid substances, but for refining other metals, for making paints, varnishing pottery-ware, for yielding oils, tinctures, and some other assistances in physic; lead will also yield silver, and some lead a quantity very profitable to the owner.

SECT. III. Of this metal many mines have been anciently and lately worked
Mines of lead in Cornwall^d, and in many places it is discovered among other metals but in too small quantities to yield much profit. The mines at

Penrose, near Helston, have been wrought above two hundred years, and have yielded tolerable profit within these thirty years; the ore is mostly of that sort called Potter's ore, but sometimes yellow^e. Dr. Woodward (vol. II. page 29) gives a very advantageous character of the ore found at Guarnek, in the parish of St. Allen, near Truro. "It was a blue lead ore, very rich in silver, perhaps beyond any in England besides: this ore, when only dressed, sells for eight pounds a ton, which is about the value of lead itself; one of the proprietors, and some of the workmen, averred, that a ton of this lead yields one hundred and forty ounces of silver: the vein of ore was about a foot over, but in some parts near three feet, and about fifteen fathom deep."

SECT. IV. Lead is for the most part of a greyish blue colour in the mine, not much unlike what it is in the metallic state. Of this kind there are several sorts; as, first, potter's or tessellated ore, consisting of a shining, rectangled, tabulated structure, and always breaking into granules of like parallelopiped shape; and, when lead is cheap, this ore, well cleansed, is worth about six pounds a ton. This is found in Sithney, Camborn, and many other parts of Cornwall. Secondly, that which is of a flaky, smooth, and glossy texture, not breaking into cubical dies, but more ponderous, and therefore containing more lead. Thirdly, a very close-grained ore, breaking into an uneven sparkling surface like a grey tissue, very rich in silver. This is scarce in Cornwall^f.

^c Boerh. by Shaw, page 59.

^d In the parishes of St. Meran, Boconeck, Piran-Sands, St. Agnes, Crowan, Sithney, Gwinear, St. Ifsy, St. Columb, Illogan, and Camborn. The works most noted formerly, are those of Penrose, Penworsey, Trevascus, Relistian, and Guarnek. See Woodward's Cat. vol. I. page 217, 218, and vol. II. page 30.

^e Woodward's Cat. vol. II. page 28, line 22.

^f Some of it was sent me from the works at Beerferris in Devonshire, and I have it also from Cardiganshire in Wales. There is a mock-lead very shining, and like the true of this colour; the irregular shape and texture of its granules, and its want of weight, will discover it. By fire, it will divide into a powder, which may be strewed upon writing.

Lead is sometimes found so involved and hidden in spar, that, were it not for its eminent weight, no metal would be suspected. Some of this spar is like a pumice-stone^g, some granulated, others of a fibrous striated texture, like the splinters of a bone glewed together, and of a brownish colour^h; some of a tabulated crystal, making little or no effervescence with *aqua fortis*, of a whitish ochrous colour, transparentⁱ; another sort of white transparent spar in straight-lined columnar *striæ*, from Cardiganshire in Wales, of which we have some also in England. Some ores of this metal are cavernous, in green crystals, which are scarce: at Misnia, in Germany, it is found in beautiful colours, in Mendip hills Somersetshire, in Denbighshire, and at Penrôs in Cornwall^k. Of like sort, but in a more ochrous feeder, I have seen lead-ore broke in the tenement of Nanskêg, in Illogan parish, bedded in a yellow clay of the exact colour of sulphur, without any other sulphureous sign but that of colour, very heavy, and reckoned rich in lead. This last ore is variegated in St. Ifsy works, Cornwall^l. We have also in Cornwall a foliaceous talky kind of lead-ore, but what I have seen is light in comparison, and of less beauty than the striated talky lead-ore from Ireland, which is white, speckled with purple, and exhibits very elegant specimens. Lead is seldom, some think never found in a native, that is, in a metallic state; but Dr. Woodward^m has given us an account of one specimen of this kind, and Linnaeus has native lead found in Germany, which he calls *Plumbum nudum* (*Syst. Nat.* page 184, N°. I.) Lead is also said to be found compleat and malleable in a mine of the island Jamaica. It is however very scarce, and in general, if lead-ore will yield three parts in four of the metal, (*viz.* seventy-five out of one hundred) it is reckoned very rich, but if it yields only forty out of one hundred, it is not worth working, unless easy to come at. Lead-ore may be very rich in lead, and yet not afford one grain of silver; and, on the other hand, the ore which is poor in lead, does sometimes yield silver plentifully. As to the potter's ore, the smaller the grains the more silver they are likely to contain, and *vice versa*ⁿ; but where-ever silver is found incorporated with lead, extracting the silver does by no means impoverish it; if the assay be skilfully performed, it leaves the lead in a better and more useful state than it was before^o; but lead is very apt to consume and lose of its weight every time it is melted; upon this, and many other accounts therefore, it requires a skilful hand to make the most of it.

^g From Turkey.^h From Tipperary, in Ireland.ⁱ From Ireland.^k See Woodward's Cat. vol. II. page 28.^l Ibid. vol. I. page 217.^m Ibid. vol. II. page 28, l. 23.ⁿ Grew's Mus. R. S. page 329.^o Sir Hum. Mackworth, page 41.

SECT. V. Our lead-veins in Cornwall generally run east and west, but are not large in dimensions, nor so lasting as the veins of this metal in some parts of Wales, in Derbyshire, and other parts of England, and seldom or never yield much lead, excepting when they are crossed by other lodes, and then they make what the miners call a Bunch, or bank of ore, just in the place where the fissures intersect. Tho' this be the general course of lead-veins with us, yet the widest and richest lodes of this metal which we have in Cornwall, are observed, as I have been informed, to run north and south. Lodes of lead in Britain, says Pliny^p, when exhausted, after resting awhile, are replenished with the same ore. The matter of fact is much to be questioned; yet if there be such successive renovations, it cannot be from the air, as he imagines, but from the water, which circulates the contents of the adjacent *strata*, and deposites them in the retentive hollows and fissures of the mine. Lead does not throw itself into such a variety of figures as tin; the only regular shape in which I have yet seen lead-ore in Cornwall, is that of the parallelloped kind, called the Dice, or tessellated ore: three of these in their natural size, are inserted Plate xx. Fig^s. xxxiii, xxxiv, and xxxvii. (the largest grain of lead I have seen); and, for the satisfaction of the curious, two specimens of the Tipperary lead are added, Fig^s. xxxv and xxxvi, ibid.

SECT. VI. Though lead has been discovered in so many parts of this county, Little wrought in Cornwall. we have not any one mine of note, excepting only in St. Ifsy near Padstow, in present working, upon account only of the lead; but as our grounds are so subject to this metal, and in some places the ore is so rich in silver^q, and yet so latent, disguised, and, as appears from what has been said before, of such various associations, that no two fossils can be more unlike than some sorts of lead ore; and as new disguises, not here particularized, may occur to the curious; and particularly as the ore richest in silver has no more than the appearance of spar, and sometimes common clay, the gentlemen of Cornwall have reason to be cautious that a great deal of this precious metal be not thrown away, as good for nothing, by the unskillful miner, and that the several sorts of lead-ore, as they are raised, be carefully examined, and separately tried; and because few miners know or can distinguish lead, or will be at the pains of procuring proper information for their masters, when they meet with any thing new, it is much to be wished that gentlemen, who have property and leisure, would acquaint themselves with the easy process of assaying metals, or would subscribe towards the maintaining a

^p Lib. xxxiv, chap. xvii.

^q See above of Guarnek.

general assay-master, who should not only be obliged to assay, but come to the spot upon proper notice, and examine, at the side of the mine, any new or likely product which the ground should afford. It might also be a part of his province to procure constant quarterly information of the price of metals and ores at all foreign markets. It has been mentioned before¹, that the true black lead, or molybdæna, is found in Cornwall; and if a vein of this lead, which is found no where in Europe to any purpose but in the county of Cumberland, should offer, as is not unlikely, it is in some danger of being neglected or thrown away, because it is neither tin, common lead, nor copper.

Quicksilver found in Cornwall I have not heard of, yet it is thought by some mineralists a standing rule, that where copper abounds, there is always quicksilver². Most likely it is so mixed and entangled with other bodies, that our miners, not seeing it liquid, never endeavour to discover it in the cinnabar or ore; neither do they at all heed that quicksilver is found sometimes in hard stones of a saffron, and blackish colour³; in both cases it is very easy for it to escape our labourers.

C H A P. XIX.

Of Gold found in Cornwall.

IT has been questioned whether there was ever any gold worth SECT. I. notice in Britain⁴, and Cicero⁵ says, that, according to his information, there was neither gold nor silver in Britain; but Strabo⁶ and Tacitus⁷, who must have had better information, confess both, and the latter intimates, that these precious metals were the Roman motives to conquer Britain⁸. Mr. Carew informs us, page 7, (and Camden from him) that some little quantities of gold were found in his time, but so inconsiderable that they were usually sold for a few half-pence. Mr. Scawen, who writ near the middle of the last century, says, that “gold has been made out of the Cornish tin-works.” Mr. Boyle⁹ observes, that “he had by him some fine gold, which never endured the fire, taken out of tin-ore,” most likely from Cornwall; for Sir Humphrey Mackworth¹⁰, in his pre-

¹ See page 130 of semimetals.

² See before of copper, page 208.

³ Boerh. page 76.

⁴ Musgrave, vol. I. page 169.

⁵ Ad Famil. tom I. lib. VII. epist. VII. edit. Elze. & Hack. 1676.

⁶ Lib. IV.

⁷ Vit. Agric. chap. XII.

⁸ Fert Britannia aurum & argentum pretium victoriae.

⁹ Philos. Transf. N°. xix. page 339, and general heads, page 39.

¹⁰ Curiosities of England, page 24.

face, says, “the tinners of Cornwall do now frequently find little quantities of gold and silver among the tin-ore, and Queen Ann (1702) granted a patent to Mr. Robert Lydall of Truro, for separating gold and silver from tin by precipitation in a reverberatory furnace by some peculiar fluxes.”

SECT. II. These discoveries have been lately advanced: in 1753, some persons^c of the parish of St. Stephen's Branel, streaming for tin in the parish of Creed, near the borough of Granpont, and perceiving some grains of a yellow colour, very small, but yet so heavy as to resist the water, culled out some of the largest grains, and carried the tin to a melting-house near Truro. The gold was in such plenty in this tin, that the melter, Mr. Walter Roswarne, taking the gold at first for mundic or copper, “blamed them for bringing it for sale without having first burnt it; but, upon assaying the ore, found it to make a very great produce, and exceedingly fine metal: the miners then took out of their pockets several pieces of pure gold, and one stone as large as a walnut, with a pure vein of gold in the middle of the stone, about the bigness of a goose quill; the clear bits of gold, and that in the stone, were then assayed, and produced just an ounce of pure gold ^d.” The tinners became afterwards more attentive to what was mixed with their stream-tin, and at several times are supposed to have sold somewhat considerable. This piece of good fortune not remaining any long time a secret, the tinners in the adjacent parishes of St. Stephen's Branel, St. Eue^e, and St. Meuan^f, followed their example, and have rather had better success this way. At Luny, in the parish of St. Eue, James Gaved, a streamer there, found native gold immersed in the body of a blue sandy flat: “He has also seen gold (as he says) *kerned* about spar,” that is, fixed and concreted on the quartz^g; but it is very rare to find it thus incorporated. Mr. Roswarne above-mentioned suspects, as he informs me, that there is gold, more or less, in all stream-tin in the county, having seen it in tin brought from St. Eue, Creed, St. Stephen's, St. Meuan, Probus, Kenwyn, and many other parishes. He has now by him one piece of pure gold, brought him by the forementioned persons, which weighs to the value of twenty-seven shillings, another that weighs in value seventeen shillings: he has seen two or three bits from Probus which weighed about fifteen shillings, intermixed with *white spar* or quartz: I have one which weighs half a guinea; but the largest piece found in Cornwall, which has reached my notice, is that in the possession of William Lemon, Esq; of Carclew, which weighs in gold-coin three pounds three

^c Charles and Samuel Trethewy.

^d Letter from Mr. Roswarne, February 11th,
1756.

^e At Luny.

^f At Trelowa.

^g In Cornwall called Spar.

shillings,

shillings, or fifteen pennyweights and sixteen grains, brought him in the latter end of September 1756. The dimensions of this piece of gold may be seen Plate xxii. where Fig. xxv shews the thickness, and Fig. xxvi the side-view or width of this piece of pure gold ; and from the compressed shape, Fig. xxv, it appears to have come from a vein half an inch wide at a medium. On each side it has a light-brown, fatty earth, which is the only impurity it is mixed with. It was found in the parish of Creed, near the borough of Granpont.

That gold lies sometimes so intermixed with tin was not unknown to the ancients ; Pliny (lib. xxxv. chap. xvi.) gives us a plain account of these metals being found together in the same manner as we find them now in Cornwall, the tin in *calculi*, (that is, smooth, pebbly ore) of the same gravity as the ore of gold*, and separated by searsing. “*Separantur canistris*,” says he, (not *caminis*, as in some editions) that is, by baskets of the same nature and use as our searses. Besides this detached gold, gold is also immured, if I may say so, in tin ; the tin-crystals, Fig. xx, xxii, and xxiii. Plate xx. have not only *flammulæ* or sparks, but also streaks of gold ; gold has the same appearance sometimes in foreign parts. “At Wunsiedel, in the margraviate of Baireuth in Germany, tin-grains of various colours, holding particles (*flammulæ*) of native gold, are not uncommon^b. ”

This late discovery of gold in Cornwall is therefore neither without former precedents, nor at present of any great importance ; it is in its infancy, though known one thousand seven hundred years since ; and, if pursued, will at least gain my countrymen the credit of industry, if it should not produce the profit which industry deserves. Some circumstances in this discovery, however, may well claim our farther attention. First, This gold found in the parishes above-mentioned, is always intermixed with grains of tin-ore, which, by their roundness and smoothness, shew that they have been washed down from the neighbouring hills. Is it not likely then that the same hills contain gold as well as tin, each in their mineral state ? for native gold fixed in the stone, and veining it, as well as in separate grains, is now found in Cornwall ; and native metal is but the accidental defæcation of the ore by subterraneous *menstrua*. In America gold is found in veinsⁱ as other metals are found here with us, and it is most likely that the gold-dust found in Africa and Asia, in the sands of brooks and rivers, all comes from the veins in the hills adjacent, though not worked by the ignorant Moors and In-

* Tin purified is the lightest of metals, but in the ore the heaviest.

26, 1755.

ⁱ Alonzo Barba of Oruro mines, page 75.

^b Letter from Mr. E. Dacosta, F. R. S. June

dians. Should not therefore all uncommon ores near these places be well examined, not only by washing, but by the more certain criterions of quicksilver, fire, and the hydrostatic balance? Our streamers know indeed native gold, but gold is not always apparent to the eye; sometimes it is found in brooks, as in Larecaja in American Spain^{*}, in colour and shape like small shot (the ore being smoothed and rounded by the agitation of water as our tin-grains); of these they melt away the outward coat, and then the granules are of a red colour: Sometimes gold is found in the clefts of rocks[†], of a grey colour on the outside like unto lead: Sometimes the ore of gold well powdered must be tried and collected by quicksilver, or great loss will ensue, and the gold be washed away. Again: Gold is often found mixed and incorporated with other metals; with copper often, with silver still oftner, and sometimes inserted in tin-crystals, but mostly bedded in diverse sorts of stones[‡], and sometimes to the depth of one hundred and fifty fathoms.

It may be worth while therefore for people to acquaint themselves with these different appearances of this most precious metal; and since we are convinced by these late discoveries, that we have more gold in Cornwall than was ever formerly imagined, it may reasonably be suspected, that in our Copper and tin, in the state of ore, and for want of a proper commixture of quicksilver, a great deal more escapes us than we collect. Lastly, in working the mines of those hills in St. Stephen's, St. Meuan, and St. Eue, for which there is such apparent encouragement, careful and intelligent persons should be appointed to superintend the bottoms; besides, the brooks and rivers, which run from those hills, might probably pay well for searching.

SECT. IV. Before I finish this treatise of metals, I cannot but take notice that some learned men, observing most mines to be on rising grounds, have thence concluded that mountains were necessary to the production of metals; and Mr. Ray (Creat. page 216) doubts whether there can be any generation (as he calls it) of metals and minerals in perfectly plain and level countries; with submission, there is very little reason for this doubt. A mountain, *quatenus* such, has no more to do with generating minerals than a valley; it cannot be owing to its shooting up into the air that it becomes metallic; the unevenness of the outward surface of the earth can have no effect this way: if there be any generation, it must be owing to the concurring materials contained in the bowels of the mountain, materials as well spread in the lowest valleys (though perhaps somewhat deeper immersed) as in the highest hills, and as apt to unite and form a body of ore in the one as in the other: in short, metals are

* Al. Barba, page 74.

[†] In Coroico, ibid.

[‡] Ibid.

disposed

disposed in such particular districts as it pleased God (who divides his different blessings among the different parts of his world) to distribute them, and in such parts of these districts they are found as they were either originally lodged in, or have been transferred to, accumulated, and deposited in by after-movements; and we find in Cornwall (where we have no hills which deserve the name of Mountains) our lodes, in low as well as rising grounds, stored with metals, without any regard to the height of the one, or depression of the other: It is true, hills and mountains facilitate the discovery and raising of metals, but cannot increase them where they are, more than the lowest valleys, (the inward structure of the *strata* being nearly alike) much less generate them where they are not. If there be any superiority with respect to metals, it must in all reason be to the advantage of the lower grounds; for where-ever the waters percolate, they may translate in some degree the metallic particles, and it must be from the higher to the lower, not from the lower to the higher parts of the *strata*.

C H A P. XX.

Vegetables of the Land and Sea.

TH E oak, ash, and elm, and other forest trees in Cornwall, SECT. I. are mostly situated round the dwellings of the inhabitants; in other counties, the willows in the vale, and the beech and other tall trees upon the hills, adorn the whole county: it is otherwise in Cornwall; but this deficiency is not owing to any incapacity of soil, or sourness of climate, but to this; that husbandry and planting, which separates counties into fields and inclosures, came late into use here in Cornwall, and have not yet prevailed upon the planter, at least in the westernmost parts, to surround his meadows with poplar, willow, or alder, or edge his hills with elm, oak, and beech. There are some other reasons why we have few large plantations in Cornwall. All the Duke of Cornwall's ancient parks* in which there was (according to the old manner) a great number of forest-trees, and much copse, being dissparkled by Henry VIII. upon a supposition that the ground would turn to better account in tillage, the wood was destroyed; but, by some mismanagements, the royal intent was never answered. Another reason of the scarcity of woods is, that *blowing* of tin (that is, melting it with wood fire^a), has much diminished and consumed our wood by charking; the manner of smelting tin-ore with pit-coal having not been practised

State of
planting in
general in
Cornwall.
Forest trees.

* Nine, I think, in number.

^a See page 182.

more than sixty years. Another reason of the scarcity of wood in Cornwall is, that some of our ancient woods are now covered with the sea^o, as particularly between Ramhead and Loo, and, in the west, betwixt Penzance and St. Michael's Mount, and very likely on some of our other strands. However, some small woods, or rather large plantations, we have in Cornwall, which are mostly situated in the valleys adjacent to our four great rivers, *viz.* the Tamar, Fawy, Fal, and Alan; cultivation beginning, as is most likely, and gentlemen of fortune building their seats on the banks of rivers for delight and conveniency. In these situations therefore we have some old woods; at Godolphin there is a very ancient and extensive plantation round the house, as there are also at some other ancient seats, and at present no gentleman builds without allotting a proportion of ground to his forest-trees and gardens; also we have several plantations lately raised and laid out in a more unconfin'd and rural manner than was formerly the custom^p; so that at present the taste for planting is general, and oak, elm, and other forest trees, but above all the several kinds of firs and pine, are propagated with great success. We must not expect indeed in our southern climate, that the fir will be of any great utility; trees have their climates, and may live, but never come to perfection out of them; this tree in particular, though found fossil in some parts of England^q, covets the more northern colds, which compress and strengthen the fibres, and insipiate the juices more than warmer climates can do; and the firs in Cornwall (some of fifty years standing) I have observed short-fibred, the timber not resinous, smooth, nor well compacted, in no wise comparable to that of Norway. However, the fir-tree may be the winter garnish of our gardens, and at least compensate the culture by its continual verdure.. Several trees, unknown here in the last generation, have also been introduced, and rise to the credit of the owners, as well as to the ornament of their groves. Among the rest, it should not be forgotten, that the plane-tree, of which the ancients were so fond, which history has thought it worth while to record as planted at Delphi by Agamemnon's own hand, which Xerxes thought worthy of a golden wreath, and dedicated solemnly to a peculiar deity, a tree whose several stages Pliny^r has traced from Syria through the Grecian Islands, till it arrived in Italy, and pass'd thence to the western parts of Gaul^s--Let it not be forgotten, that this tree, so deservedly celebrated, and for its broad leaf and

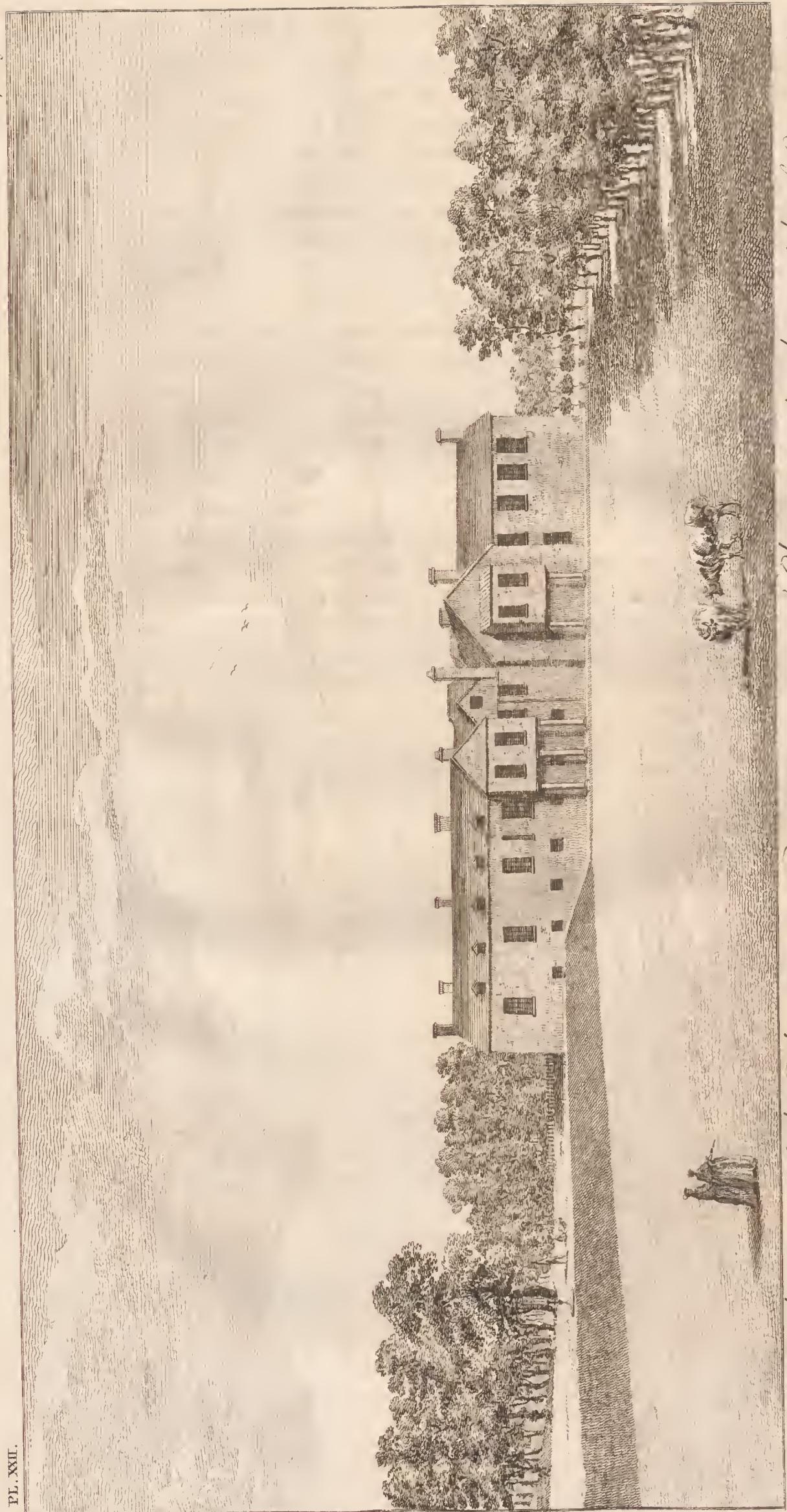
^o See the Ancient and Present State of Scilly Isles, page 94, 95.

^p At Anthony, Port Elliot, Trewithen, Tre-gothnan, Carclew, Nanfwhydn, Tehidy, Clow-ance, Treloarren, Trevetho, Enys, Castlehornek, and others.

^q In Lincolnshire, Ray's Discourses, page 233, and Staffordshire, 237, *ibid.* and Lancashire, Dr. Leigh's Nat. Hist.

^r Lib. xvi. chap. XLIV.

^s About the time that Rome was sacked by the Gauls, lib. XII. chap. 1. *ibid.*



A. J. Mr. John St. Polyn Barlow,
Cornwall, engraved at his expense,
is most gratefully inscribed by
Wm Borlase



wide-spreading shade exceeding all the trees of the wood, was introduced into these western parts, about the year 1723, by the late worthy Sir John St. Aubyn of Clowance, Baronet. He found his paternal seat naked and fenceless, bereaved of its old plantation; he applied himself to restore, and left it in a fair condition to rival the most considerable planted grounds in the county.

Some accidental singularities happen to our forest-trees in Cornwall, as elsewhere. The ash-tree has sometimes its leaves variegated with white, but having kept one several years, I could never perceive that it made healthy vigorous shoots, but the contrary. The oak called Arundel's Oak, in Lanhadron park, in the parish of St. Eue, mentioned by Mr. Carew¹, bore its leaves speckled with white, and, as the neighbourhood fancied, the leaves were never of one colour but immediately before the death of the Lord; but the most remarkable alteration in the colour of leaves that I have heard of, is that which is reported to have happened to "an oak near the mansion-house in the park of Boconeck", in which King Charles I, when in Cornwall, set up his standard: the leaves at this time were green, as in other oaks; but, soon after the King's murder, changed mostly white, and continued so till about thirty years since.² The truth is, that the leaves of trees become variegated by some infection communicated to their sap; when they imbibe the poison, some obstruction, feebleness, and decay of their vessels ensues, and the juices are not so duly secreted and concocted as before.

Fruit-trees have been at least as much cultivated of late years in SECT. II. Cornwall, as those of the forest. There is no gentleman now ^{Fruit-trees.} without his peaches and nectarines, as good as any; the apricots do not thrive with us in the westernmost part; they blossom well, and bear tolerably, after they are come to maturity, for a year or two, but never after; they have been tried in different soils, under good direction, and all kinds of shelter, but to little purpose; perhaps our air is too sharp and salt for them:³ Cherries, pears, and the more useful apple, have been cultivated to great advantage within our remembrance, and a great deal of cyder made, which by proper choice of the fruit, and judicious racking the settled juice, has been greatly altered for the better, as well as increased in quantity, within these thirty years. In the latter end of Elizabeth, Mr. Carew (a gentleman very intent upon the improvement of this county) seems

¹ Page 140, and from him by Mr. Norden, page 57.

² Late Lord Mohun's, now belonging to Thomas Pitt, Esq;

³ "This account, says my author, (Mr. Cockran) in a letter, sent me about thirty years ago, he had from Mr. Dennis, Mr. Aubyn, and Mr. Alexander, (who was a justice of the peace) all

three gentlemen of estates, who have it from ancient people (whose families knew the oak before the King's death) and have themselves viewed it." Dr. Brown-Willis to the author, April the 15th, 1756.

* The mulberry fruit does ripen well in the westernmost parts of Cornwall, as I have observed for thirty years last past.

to wonder why more vines are not planted in Cornwall, so much nearer as we are to the southern sun than any other part of England; but being more southerly in situation is not the only thing requisite to vineyards; our Autumn, which is the time for gathering grapes, is generally wet; then, our summers are never hot, (it being hotter in the most northern inland counties of England than with us) consequently they cannot ripen the juice to that flavour and spirit which making of good wines indispensably requires: I much doubt therefore whether vineyards in Cornwall will ever answer. Hop-gardens have been much improved of late years, and in many parts of the county supply the inhabitants with a sufficiency for their malt-liquors; but the major part of what is used, is imported from London.

SECT. III. From trees above ground, let us descend to the subterraneous Fossil-trees. vegetables called Fossil-trees. In the year 1740, Christopher Hawkins, Esq; of Trewinard, draining a marshy piece of ground on the banks of the river Heyl in Penwith, found several pieces of oak, buried four feet deep or more under the surface, in a fast clay; one large stock of a tree about ten feet long, had no branches, its top part pointed to the downhill, the colour of it very black. The timber was hard and firm, and indeed timber never decays as long as the oil, one of the chief ingredients in the composition of plants, is kept in its proper place; perpetual moisture effectually performs this; but let the warm air exhale this oil, and the ligneous parts shall imbibe and evaporate their moisture, extending alternately, and then contracting and shrivelling the tubular vessels: a separation then (in which all destruction consists) ensues, and the parts disunite, which were before glewed together by an inimitable mixture of oil, earth, and water. Land-floods seem to have loosened and overthrown these trees, and the adventitious soil, washed down from the neighbouring hills and tin-works by the river Heyl, (which has contributed to choak the harbour below) gradually interred these trees deeper after they were fallen. In such situations, that there should be fossil-trees is not to be wondered at, and I believe there are few such without them; but we must look out for other causes, where the circumstances of the ground, and the properties of the trees discovered, manifestly differ. In the year 1750, John Roberts, of the parish of Senan, digging for tin near Velindreath, found, at the depth of thirty feet, an entire skeleton, about the bigness of that of a large deer, but such a set of bones as he had never before observed: The beast lay on its side, and near it, in a line parallel to its vertebræ, a prostrate tree of twenty feet long, about the diameter of a moderate man's waste; great numbers of leaves were

were on the branches, some large, some small, and the impression of the leaves was plain in the earth. The tree was of the oak kind, and so soft in some parts, that the shovel stuck in it, but extreamly hard at the knots and spurs: not far from the skeleton, but unconnected, lay part of a deer's horn two feet and a half long, thicker than a man's arm-wrist, with the branched antlers to it; one of the knobs was as big as a man's fist, but, as soon as this part of the horn was touched, it crumbled to duft; one tooth which I have was taken from the skeleton, with several other pieces of deer's or elk's horn, found, in the same place, in the year 1753, twenty feet under the surface. The *stratum* in which they lay was the same shelly sand as that of the sea-strand adjacent for nine feet, then a sandy earth intermixed with small stones, which the tinners call Cothan, (wherein the sand-tin is usually found) about a foot and a half above the karn. The question here will naturally occur, how this tree and the skeleton became interred together. There is no sign of a tree any where near this place, nor any record of such creatures as the elk or moose-deer (to which these horns are most usually ascribed *) having been ever in this country; besides, although the horns of such creatures are sometimes found, "the bones of them are a rarity;" yet, by their lying in a parallel line, they must have fallen together, and the same violence likely that overwhelmed the beast must have also prostrated the tree. This must therefore either have happened at the universal deluge, when the same waters which had unfooted the tree, and drowned the creature, retiring, drew them both towards the ocean, or by some sudden subsidence of the shelving part of the hill, when the land sinking hurried away both the creature and the tree in one direction: to one of these causes the reader will probably ascribe this unusual phænomenon. The first may seem most likely, because the tree and the creature are found deposited at that depth where tin-stones, rounded and dispersed by the flood, are usually lodged; and yet, that there was anciently a sudden subsidence of the ground in these parts, has been a constant tradition for some ages.

A third sort of fossil-trees is sometimes discovered in lakes, bogs, and harbours, in whole groves together, and some trees among the rest standing as perpendicular as they grew. This is a phænomenon most likely owing to the subsidence of the ground, it being no unusual accident (sometimes perhaps by the undermining of the sea, as Mr. Ray imagines *, but oftener in earthquakes) for the ground to sink, and a lake of water (where there was dry and planted land) to spring up and fill the cavity. On the strand of Mount's

* Though I think it uncertain whether these horns belonged to the elk or the common stag of our own country, they having no broad plated

fangs as the horns of the elk always have.

* Theological Discourses, page 229.

Bay, midway betwixt the piers of St. Michael's Mount and Penzance, on the 10th of January 1757, the remains of the wood which, according to tradition, covered anciently a large tract of ground on the edge of Mount's Bay, appeared. The sands had been drawn off from the shore by a violent sea, and had left several places, twenty yards long and ten wide, washed bare, strewed with stones like a broken causeway, and wrought into hollows somewhat below the rest of the sands: this gave me an opportunity of examining the following parts of the ancient trees: In the first pool, part of the trunk appeared, and the whole course of the roots, eighteen feet long and twelve wide, was displayed in a horizontal position; upon spading round, we found the sand to be a thin layer only of ten inches deep, and then the natural earth appeared, in which the roots remained so firmly fixed, that, with a pick and crow of iron, we could not get off one piece, but were content to saw off what we could come at. The trunk at the fracture was ragged, and by the level range of the roots which lay round it, was part of the body of the tree just above its division into roots. Of what kind it was, there did not enough remain above the roots positively to determine: the roots were pierced plentifully by the *teredo*, or auger-worm. Thirty feet to the west, we found the remains of another tree; the ramifications extended ten feet by six; there was no stock in the middle; it was therefore part of the under or bottom roots of the tree, pierced also by the *teredo*, and of the same texture as the first. Fifty feet to the north of the first tree, we found part of a large oak: it was the body of a tree three feet in diameter; its top reclined to the east. In this much more solid wood, the *teredo* had made no lodgements; we traced the body of this tree, as it lay shelving, the length of seven feet, but to what farther depth the body reached we could not discern, because of the immediate influx of water, as soon as we had made a pit for discovery. The earth reached within six inches of the surface of the sands; but so firmly rooted was the tree, that no sledge could move it: not so fixed was the stock of a willow-tree, with the bark on, one foot and a half diameter, within two paces of the oak, where, upon endeavouring to cleave off a part of the willow, the earth shook so much under the people at work, that they were in some doubt whether they had best to proceed: the timber of the willow was changed into a ruddy colour by lying so long in salt water. Hard by, we found part of a hazel-branch with its fat glossy bark on. The earth in all the tried places appears to be a black, cold, marsh earth, covered only with a thin layer of sand, but very little intermixed. In it we found fragments of the leaves of the *Juncus aquaticus maximus*; and had any flowers appeared,

appeared, they would have pointed out the season of the year when all these vegetables were interred, but I could find none.

The place where I found these trees was three hundred yards below full-sea-mark; the water is twelve feet deep upon them when the tide is in. These several phenomena will enable us to draw from them some interesting observations.

First, That the body of these trees must have stood at least twelve feet higher than at present; consequently there has been a subsidence on these shores, and the ground has sunk more than twelve feet.

Secondly, These fossil-trees sufficiently confirm the tradition of these parts, that, where the sands are now stretching three miles in length, and a furlong (when the spring-tide has retired to its full extent) in breadth, from the town of Penzance to St. Michael's Mount, there was formerly a wood^y.

Thirdly, From the different levels of these vegetable remains, the body of the oak being many feet deeper than the undermost roots of the second tree, it is plain that this subsidence could not have been equal in all its parts; the land sunk in some places more, in some less (as is usually the case in all subsidences, occasioned either by earthquakes, or by the sea's exhausting the *strata*, as Mr. Ray imagines, or by whatever other cause^z), the subsidence being in proportion to the depth of the cavities underneath, as well as according to the solidity and texture of the shell above.

Fourthly, This subsidence of the earth had different tendencies in its several parts; the first tree seems to have preserved its perpendicular situation, and to have leant only a little forward towards the south, but the oak descends obliquely into the sand with its top reclining to the east; the motion therefore, which occasioned the subsidence, was undulating.

Fifthly, The ground which sunk, appears to have been a swarthy, marshy plain of land, not much unlike the lower lands of Gulval and Ludgvan, parishes adjoining, covered thick with trees of the oak, hazel, and willow, at least, if there was not a greater variety.

Sixthly, This subsidence having happened so many ages (probably near a thousand years) since^x, without being followed by any succeeding convulsions or depressions of the earth since that time, (as far as we can learn) intimates to us, that where there are such subsidences at the time of earthquakes, there is less danger of return, than where there are none; the caverns below, from which the momentum proceeded, being filled and choaked up by the falling in of the earth, and consequently successive earthquakes are not to be dreaded; but where there are no subsidences, or very small

^x Leland Itin. vol. III. page 7. Carew, page 3.
Observations on the Scilly Isles, page 92, &c.

^y See observations on the Scilly Isles, page ibid.
ut supra.

^z See page 158 and 159 before.

and partial ones, in proportion to the agitations of the earth, (as was the case of Lisbon in the late dreadful earthquake of November 1755) the caverns continue open as before, and the inflammable matter is at liberty to range, ferment, and expand itself, and consequently produces new and frequent emotions of the earth, and that this is likely still to be the case till the cavernous passages below are closed up by the subsidence of the grounds near the surface.

Lastly, These swampy pits of marsh earth retaining their moisture, protected as they are from all exhalation by the sea and sands above them, are in the state of quagmires; and when the sands are dispersed and thinned, (as will happen by the storms and the *out-hall* of the sea) the quagmire is not sufficiently covered: this is the reason that these and other sands are occasionally quick and sinking, and give way to any incumbent pressure; but the sands in this place are never dangerous, as they are in other places, where the interred bogs are more lax and deeper^b.

SECT. III. From trees let us descend to shrubs. It is suggested that the Of shrubs. sweet-brier, or eglantine^c, does not grow naturally in Cornwall; but this is a great mistake, as, from experience, I can aver, having plucked this perfumed plant out of the hedges in the neighbourhood of Mount's Bay, and transplanted them into my own garden, where they flower in as great perfection as any where, and may be easily multiplied by seeds, slips, or cuttings. The furze-bush (or *ulex*) grows in great plenty, and affords cheap fuel to the poor. We have two sorts of it, one a dwarf-furze of a small prickle and branch, in the coarsest, shallowest soil, which we call Cornish furze, never growing three feet high, flowering in autumn; the other five, six, and eight feet high, more woody, thriving best in a deeper and more tenacious soil, this makes a more lasting and fiercer fire; we call it French furze; it is the *genista spinosa vulgaris*^d, and blossoms in the spring. Its leaves are of a deep green, and its yellow flowers so numerous and sweet, that some gentlemen have raised hedges of it in their gardens, but the leaves are soon cast, and the hedge grows bare and sticky, so that experience, I think, does not favour the attempt. Among the Cornish furze is great plenty of the common heath, (or *erica*) a plant which by its roots makes the turves cut up for fuel much the better, but its branches impede and weaken the furze. The Danes drew an intoxicating liquor from the *erica*, and some think they accounted it so precious as to erect lines of large stones for boundaries to limit the properties of this plant^e.

^b See page 75.

^c *Rosa filiflora foliis odoratis*, Ray. Stirp. Brit. page 454. 3d ed.

^d Ray, ibid. page 475.

^e Hist. of Cork, vol II. page 358.

The great esteem in which the ancient Cornish held the Elder (or *sambucus*) is very remarkable; the Cornu-british words for it are *scau* and *scauan*, and hence we have many villages^f, and two ancient families^g denominated. It may at first seem to be owing to the general scarcity of trees that even this humble shrub was thought considerable enough to give name to so many places; but if we consider the great virtue of this plant in all its several parts and stages, we shall be convinced that few shrubs deserve a greater regard. It is very hardy, enduring all weather, suiting all soils, easily propagated by seeds and cuttings: the medicinal use of its several parts is extraordinary; its leaves, buds, blossoms, berries, pith, wood, and bark, have more virtues than can possibly have room here without entering into too minute a detail; the following are most obvious, and most generally applied to for relief: The buds and leaves, as soon as they appear, are gathered to make baths, fomentations, and cataplasms for wounds, and are a remedy for inflammations, &c. As soon as the flower-buds come on, they serve to make a pickle of very good flavour; the flowers at their opening, infused, communicate their taste and smell to vinegar; infused, and let to stand in best Florence oil, excellent to be laid over bruises and external swellings, and, taken internally, very healing and cooling: the flowers, in their natural state, are very sudorific, and asswage pains; distilled with simple water make a sweet, cooling wash for the face in summer, which takes off inflammations of the eyes as a *collyrium*, is good for the wind in children, and a very innocent vehicle in fevers; distilled on spirits it asswages cholical pains in adult persons; and there is a spirit to be drawn from the elder, which the late Duke of Somerset (who married the heiress of Piercy) took for the gout, as I have been informed, with success. When the berries are ripe, they make a very wholesome syrup in colds and fevers; and some make wines of them, by mixing rhenish or other white wines^h. Of the younger sappy branches, the bark pared off close to the wood makes a salve efficacious beyond most others for scalds; this inner bark is also very salutary in Dropfies, says Mr. Ray; the wood is close-grained, sweet, and cleanly, and beyond any other chosen by butchers for skewers, as least affecting their flesh: it is very beautiful also for turner's-ware and fineering, and, for toys, of as neat a polish as box, and the very pith of this useful shrub is proper to cool, and make ulcers and wounds digest. More uses than these may occur by way of medicine,

^f Boscauran-rôs, and Boscauan-ûn in St. Berian parish; two called by the name of Penscauan in St. Enodor; Enyscauan in St. Denis; Lescauan in Sheviock; Fenton-scauan, name of a water in St. Ives; Trescau formerly the most considerable village in the Scilly Isles; Trescau in Brêg, &c.

^g That of the Right Honourable Lord Viscount Falmouth, called Boscawen, and the Scawens of Molinik in St. Germans, and of Carshalton in Surrey.

^h Ray de Sambuco palustri.

Greenhouse
shrubs.

but the above are perhaps more than sufficient to shew that the Cornu-britans did not denominate places and persons from this seemingly contemptible shrub without great propriety : its peculiar properties are not to be wondered at, though numerous; they are indeed chiefly medicinal, and those of other plants are sometimes principally nutritious and domestic. Nature has differently distributed her bounties among plants, and placed them together sometimes in great numbers. The palm-tree, as Strabo says, has 360 uses, and the cocoa or coker-nut-tree yields wine, bread, milk, oil, sugar, salt, vinegar, tinctures, tans, spices, thread, needles, linen-cloth, cups, dishes, baskets, mats, umbrella's, paper, brooms, ropes, sails, and almost all that belong to the rigging of a ship¹, if we may believe Fr. Hernandez and other authors. Besides this *Sambucus aquatilis seu palustris*, we have another sort, which we call Scau-an-Cûz, or the Elder of the wood, some call it the Maiden Elder^k. Its uses have not been hitherto discovered to be as various and salutary as those of the foregoing, but its wood is more flexible, and will divide lengthways as perfectly almost as whalebone, and is therefore much coveted by joyners. Greenhouse shrubs may be preserved in Cornwall with less care and attendance than in any part of England, and without any artificial heat. Myrtles even of the tenderest kind, as the striped small leaved, the double flowering, and the rest, (all which are greenhouse plants in other parts of England) we keep out all winter, yet in the summer they flower plentifully^f. Geraniums and jessamins stand out all the winter, unless when the cold is extream, and then they must be housed till the severity of the weather is over, when they may out again. In the month of January, 1737, tuberoses in the dwelling-house at Ludgvan, jonquils and the small pearl-aloe in the garden, were in high blossom ; but the general mildness of the Cornish air cannot be better evidenced than by the great American aloe*, which blossomed in the garden of Mr. George Keigwin of Moushole in Mount's Bay in the year 1757, and at the writing of this^l still survives. This plant is common in hot climates, and, though it seldom blossoms, is well known to the learned in this ; but as this is the first instance of its blossoming in England in the natural earth, I shall describe and trace it. It was planted in the natural earth in the year 1724, and having stood thirty-three winters without the least covering, on the 9th of June, 1757, the flower-stalk began to eimerge from among the middlemost leaves. The stalk was round and taper, and beset with small marginal alternate leaves, above which was the insertion of each branch, as

¹ Ray's History of Plants, lib. xxii. chap. vii.
and Creation, page 208.

^k Qu. an *sambucus humilis* Raii.

^f The *Phlomis fruticosa* *salviæ folio latiore et rotundiore*, Tourn. (vulgo sage of Jerusalem)

stands altogether in natural ground, and yet in its season is covered with flowers—the same may be said of many others.

* *Agave*, *Linnæi*.

^l February 1758.

Fig. XL. *c, d*, Plate xx. page 186. It shot above five inches at a medium in twenty-four hours for the first month, but gradually less as it approached the summit. On the 21st day after its appearance the top of the stalk was fourteen feet from the ground, in which stage of growth I give it Plate xx. Fig. XXXVIII. On the 4th of August the principal parts were all formed, (as Fig. XXXIX. ibidem) the leaves six feet high; their spread eleven feet; circumference of the stalk at the top of the leaves fifteen inches; from the ground to the under branch ten feet: the branches were thirty-eight in number; they extended from the stalk at a medium two feet, each branch shooting from above one of the marginal leaves or appendices; at the extremity of each branch was its bunch of flowers, which consisted of seven or eight *pedunculi*; on each peduncle there were from fourteen to forty-seven pods, very like the white lilly pods: the pods on one branch we had the curiosity to number, and they amounted in all to two hundred and nineteen; the bunch of flowers on each branch appeared September 16, as *a, b*, Fig. XL. ibid. The corolla, or system of generative parts, *C, C*, Fig. XLI. ibid. is of the natural size; it was of a light-green colour; *a, b*, is the *capsula*, filled with clear water, sweet as honey: the top of the *capsula* is divided into six petals in the shape of fingers, which grasp the pistil *g*, rising out of the center of the *capsula*, surrounded with six filaments *e, e*, and on the point of each filament one anthera, covered with the *farina*, as *f, f*, all of a bright Naples-yellow colour. September the sixteenth the stalk, with the flowers on the top, was twenty-one feet six inches high, having grown only four inches in height from the fourth of August: the undermost branches were now nearly in full blossom, the upper ones more backward; the outmost leaves of the plant next the ground were a little flaccid and discoloured, a prelude to the approaching decay; for, as these sconces (so some have called the flower-branches) successively break forth into weighty bunches of rich yellow flowers; the ascent of sap is so copious, that the respiratory ducts, and the other necessary vessels of vegetation, become too distended ever to recover their former tone; the root also (none of the most robust) by the continual duty of supplying such quantities of moisture for the flowers, is worn out, and the stately plant blossoms but once, (as if the production was too precious to be repeated) then languishes and dies; but its decay is slow and commensurate to the time it takes up in putting forth its flowers. On January 10, 1758, about fifteen of the under branches had dropped their seed-pods, the uppermost still retaining theirs; the stalk not much shrunk, and the succulent leaves next the ground as fresh as three months before; some have lived twelve

months

months from their beginning to flower *. Of this plant the Icon was published by Camerarius in his *Hortus Medicus*, but the elevation defective, and the corolla less exactly, tab. v: still worse by Hernandez, page 270, chap. xii: by Bradley also (in his 2^d Decad. page 1, of succulent plants) far from accurately, the *petala* of the *corolla*, being too large and ill shaped, the filaments and *antheræ* too short and small. I have given the several parts in proportion by scale annexed, and the corolla in its natural size, Pl. xx. Fig. xli. This plant is of great use in America^m, serving the poor Indians for almost all the necessary purposes of life, but in these northern climates is cultivated rather for curiosity than advantage.

SECT. IV. As to our garden and culinary plants (that we may now proceed from shrubs to their inferior herbs and roots), they not only come for early use in the spring, but with little care subsist all the winter; and when pot-herbs of all kinds are destroyed by severe frosts in the more eastern counties, the tables of the gentry in Cornwall are plentifully supplied. Esculent roots also enjoy the mildness of our winter, and remain untouched with canker or frost till the succedaneous plants of the spring make them less necessary. I find the northernmost Hundred of Stratton was remarkable, in the reign of Elizabeth, for its plenty of garlick; "the countryman's treacle, says Mr. Carew", which they vent not only in Cornwall, but in many other shires."

Every thing that belongs to the flower-garden, and grows in any part of England, will thrive and flourish here, as the late accomplished and courteous Philip Rashleigh Esq; of Menabilly did formerly manifest, and his present sister, Mrs. Hawkins, (widow of the late Reverend Dr. Hawkins of Pennans) now at Pencoit, can satisfy the most curious. Our winters are usually so favourable that they are a general encouragement, such few roots miscarrying thro' frost, and spring flowers shooting so luxuriant. April 27, 1756, perceiving a number of flowers upon the stem of a polyanthos, I had the curiosity to pluck off the stalk, and found it to contain on it 353 flowers, so well does this plant deserve the name of polyanthos, or the stem with many flowers^o.

SECT. V. Among herbaceous plants here, I will not pretend to give any non-descript; some, the most useful, and most pernicious which have reached my notice, their sites and properties, with the rare plants of this county, published by Mr. Ray, or collected by Mr.

* This was blown down by a storm February 11, 1758.

manis modus; innumeri penè sunt usus." Hernandez, ibid. ut supra.

^m "Planta hæc unica, quicquid vitæ esse potest necessarium præstare facile posset si esset rebus hu-

ⁿ Page 118.

^o Of grains, see in chap. vii. page 46.

Lhuyd,



To Thomas Hawkins Esq; this South-east View
of TREWITHEN, in the parish of Probus, Cornwall,
engrav'd at his expence, is
most gratefully inscrib'd by
Wm Borlase.

Lhuyd, will be sufficient for my purpose; those who are further curious, and would have this article treated of more scientifically, I must refer to some person who will singly apply himself to this extensive science, and track it not only through all the different situations of this county, (where possibly his pains may be rewarded by some not only rare but new plants) but through the now increasing volumes of herbals, as well as the mountains and vallies of foreign countries.

N°. I. Of the hill and hedge plants, I find a kind of mercury^p with leaves like spinage: it is so effectual in the cases of sore or broken breasts of women, that by a salve made of it, a Lady of the parish of Ludgvan cured in a short time a breast^q which had nineteen holes in it.

N°. II. Arsmart (in this Church-town) distilled has been found to be better for gravelly complaints than a great variety of drugs taken with constancy, but to little purpose.

N°. III. The uses of camomel are well known; it is common in Cornwall on every hill almost, as well as the banks of rivers, but more especially in green spots, where the heath and furze which surround them have not as yet spread their roots: it thrives also in our gardens, whither it is transplanted because of its smell, and strengthening emetick tea: it is placed among the rare plants of Cornwall by Mr. Ray^r, and entitled *Chamælum odoratiss. repens flore simplici, J. B. -- nobile seu odoratius, C. B. --- Romanum Ger.* We have it with the double flower as well as the single, and equally scented.

N°. IV. "The fir-leaved heath with many flowers, *Erica foliis Corios multiflora, J. B. -- Juniperifolia Narbonensis dense fruticans Lob.* on Gunhilly downs plentifully^s." I have found it also near the Land's-End.

N°. V. *Erica flore albo*, gathered in Ludgvan parish.

N°. VI. "Blue, sweet-smelling toad-flax, *Linaria odorata mon-spessulana, J. B.* described in Camden, page 30, near Penryn, along the hedges plentifully^t."

N°. VII. A remarkable stone-crop about four feet high, *se-dum majus arborescens vulgare*^u, found in an old cellar in Senan near the Land's-End. Much smaller stone-crop of this kind I have found growing in the shade, out of old damp walls, at Godolphin.

N°. VIII. Wood-sage, *Salvia agrestis seu scorodonia, Ger*^v. at St. Michael's Mount, 1754.

^p *Mercurialis annua glabra vulgaris*. Ray, ed. 2. page 54.

^q Of Blanch French.

^r By the late Reverend Mr. Peter, Rector of Mawnon.

^s Third edit. page 185.

^t Ibid. page 471.

^u Ibid. page 282.

^v Ibid. 2^d. edit. page 151.

^x Ibid. page 133.

N°. XI. Water-mint of a spicey smell, *Mentha arvensis verticillata folio rotundiore odore aromatico*^y, a scarce plant gathered in St. Bebian under a hedge, 1754.

N°. X. Roman nettle, *Urtica pilutifera semine magno lini, seu Urtica Romana*^z, gathered in a shady ditch at Veliñvrān, August 4, 1754.

N°. XI. Sheep's sorrel, *Lapathum acetosum, repens, lanceolatum*^a, gathered on the north side of St. Michael's Mount 1754.

N°. XII. Hairy kidney wort, *Cotyledon hirsuta*^b, at Castle Trebyn in the parish of St. Levin.

SECT. VI. N°. XIII. The first I shall mention of this sort, is the *Ros solis, Drosera, or Rorella*, in English the Sun-dew, from a speck of water which rests in the middle of the leaf, even in the dryest day. In Cornwall we call this herb the *Isles*; for what reason I know not. It is so very fatal to our sheep, that they pine and die in every pasture where this plant abounds. Mr. Ray^c was not ignorant of the hurtful effects of this herb: he observes, that it is of a fiery burning nature, and that the leaf, applied to the skin, raises an ulcer; that it is accounted hurtful to the sheep, and by the farmers sometimes called the Red-rot. This pernicious quality is not owing to the nature of the herb, but to an insect or worm, which, feeding on this herb, lays its eggs on the leaf, and fixes them therein by some noxious poisonous gum: the eggs are swallowed with the flowers and leaf, and eluding the *menstrua* of the stomach, get into the chyle and blood; they are detained in the capillary vessels of the liver, where, meeting with the requisite degree of heat and moisture they fecundate, the animalcules grow^d, and there make holes in which several of them lodge together, and feed upon the liver till it can no longer perform the functions of its station, and the sheep dies. Two of these insects in natural size are given Pl. xxiv. Fig. x. *a* and *b*. The pregnant eggs of worms are taken in with food by children, and sometimes adult persons; and escaping the trituration of the stomach, lodge in such parts and hatch, where the warmth and juices are favourable to the ripening, excluding, and perfecting the *fætus*. Many sorts of fish also are subject to worms and animalcules: the mackrel has some frequently in its liver, so has the cod, especially if it has a bad habit; and the hake is very subject to worms in most parts of the flesh.

^y Ray, 2d edit. page 123,

^z Ibid. page 54.

^a Ibid. page 56.

^b Ibid. page 213.

^c Ibid. page 227.

^d Dr. Francis Nicholls M. R. F. R. S. says,

that bullocks, as well as sheep, "are subject to a small flat worm, and often many of them resembling a sole, by the butchers termed flooks: this worm always builds a wall of stone for its defence, which is ramified like a Gall duct." Phil. Trans. xxxix. for 1756, page 26.

The *Ros-solis* grows in shallow marshy grounds: I have gathered it in Torvorian commons in Senan; it is frequently found on the Barton of Ludgvan-Lez: some moors also, belonging to the lands of the Church-town of Ludgvan, are subject to it; but where-ever it grows, the owner takes all possible care that the sheep, who are fond of it, may not come near it.

N°. XIV. In the wet, spongy parts of our heathy grounds grows the black whortleberry, *Vitis idaea angulosa* of J. B. and Mr. Ray^c, the angular-stalked *Vaccinium* of others^d. In Cornwall we call the fruit, Whorts; they are the desert of the common people, but the juice much inferior to that of the common black-berry.

N°. XV. Other rare plants of this situation are the small, creeping, round-leaved, bastard-chickweed, of which I shall give a more particular account. This plant is at present known by botanists to be found in Cornwall only, and Devon. chiefly in the former. Ray^e calls it *Alpine spuria, pusilla, repens, foliis saxifragæ aureæ*; but it may be justly supposed, that he was doubtful where to class it; for he has not included it in his history of plants, nor in his supplement to it, which Plukenet in his Almagest, page 23, wonders at; and therefore adds at length a particular description of it from Mr. Ray's Catalogue, a prior work to both those before-mentioned: he also gives an icon of it in Tab. vii. Fig. vi. Petiver (Herb. t. 6 f. 11.) calls it, *Chrysosplenium Cornubiense*; the Cornish penny-wort.

Doctor Linnæus doubted a long while of the existence of this plant, suspecting that the English had multiplied the species by mistake; Dr. Sibthorp, now Professor of Botany in the University of Oxford, convinced him of its reality by sending him a specimen of the plant in the year 1750. Linnæus, out of respect to the donor, names it in his *Gen. Plantarum*, N°. 693, *Sibthorpia*; in his *Species Plantarum* describes it thus, *Sibthorpia, foliis, reniformi-subpeltatis, crenatis*^h; and in his letter to Dr. Sibthorp from Upsal, dated July 15, 1750, thus expresses himself: "Pro *Alpine Spuria* tibi immensas grates habeo, ... quia eandem pro planta ficta ex *Hydrocotyle* habuisse, nisi ipse vidisse et palpitassem pulchrum specimen quod in tui memoriam servabo." Of this doubtful plant I give an icon, Plate xxix. Fig. xi. from a fair specimen, (with several kind informations) most obligingly communicated by Dr. Sibthorpⁱ.

N°. XVI. Round-leaved, marsh St. Peter's-wort, *Ascyrum supernum palustre villosum*^k, found about spring-waters, mostly near the Land's End.

^c Second edit. page 457.

^d Hill of Plants, page 403.

^g Third edit. Synops. page 352.

^h Gen. nov. 1099, page 21.

ⁱ This is called the European *Sibthorpia*, or

Chrysosplenium; of that which grows in Africa, and is somewhat different, Dr. Shaw has given an icon at the end of his travels among the African plants, page 39, N°. 139.

^k Ray, ibid. page 344.

N°. xvii. Tender ivy-leaved bell-flower, *Campanula Cymbalariae foliis, Ger*¹. “on many moist and watry banks in this county.”

N°. xviii. The least marsh-centaury, *Centaurium palustre luteum minimum*, found “on a rotten boggy ground between St. Ives and Penzance”^m.

N°. xix. Butter-wort with a small flesh-coloured flower, *Pinguicula flore minore carneo*, “in moist meadows and marshy grounds about Kilkhamton and elsewhere”ⁿ.

N°. xx. Great yellow marsh-eyebright, *Euphrasia lutea latifolia palustris*, about boggy places, especially towards the further end of this county^o.

N°. xi. Verticillate knot-grass with thyme-like leaves, *Polygonum serpyllifolium verticillatum*, in watry places between St. Columb and Michel, about Penzance, and towards the Land's End^p. I found it at Castle-Treryn among the rocks.

N°. xxii. The least calve's-snout or snapdragon, *Antirrhinum minus*, or *Linaria*^q, gathered in a bottom in Sanctred, 1754.

SECT. VII. N°. xxiii. Among the rock and cliff-plants the samphire, Rock and cliff plants. *Crithmum, seu Foeniculum marinum*^r, may be reckoned the most useful. In the islands of Scilly this plant grows luxuriant beyond what we have in Cornwall; some boil it as a pot-herb; pickled, it is thought to help digestion: Dr. Leigh, in his Lancashire, thinks it may be ranked in the first class of antiscorbuticks: gathered in great plenty on the cliffs adjoining to the sea in Piran-Uthno parish and St. Just.

N°. xxiv. Common fennel, *Foeniculum vulgare minus*^s, in the extreme parts of Cornwall near the sea, betwixt Lannant and St. Ives, says Mr. Ray^t. Of this useful plant, the seed quickens the eye-sight, strengthens the stomach and bowels, and relieves the asthma: the leaves increase the nurse's milk, are a good antenephritic, and the root removes obstructions^u.

N°. xxv. In some little islands, or rather slightly covered rocks, (as Mullion gull-rock in Mount's Bay, Godrivy island in St. Ives Bay, &c.) one year nothing grows but mallows (the *Malva arborea marina*, as I take it, of Ray^v); the next year nothing but beets^w; the succeeding year mallows again, and the fourth year beets,

¹ Ray, 3^d edit. page 277.

^m Ibid. page 286.

ⁿ Ibid. page 281.

^o Ibid. page 285.

^p Ibid. page 147.

^q Ibid. page 283.

^r Ibid. page 217.

^s Ibid.

^t Ibid.

^u Ibid.

^w Ibid.

^v Beta sylvestris, maritima, radice perenni.

and

and so on, the mallows and beets annually taking their turn to possess the island. This is a very singular vicissitude, of which I have received frequent assertions from eye-witnesses; and it may be attributed, as I imagine, to the following cause, *viz.* That when one of these plants (the mallow, for instance) shoots vigorously*, it masters and keeps under the beet, till its leaves and stalks decay; the beet then, which lay the preceding year obscured and weakened under the shade of the mallow, shoots away more early in the succeeding spring, and having the start of the mallow, overtops and masters it, till the beet decays, and then the mallow prevails in its turn. To make these plants shoot in full strength, and maintain their yearly sovereignty, the spray of the sea, the *fæces* of the birds, (with which these rocks are perpetually discoloured) and their own putrescent leaves and stalks may contribute; but as I have never visited these rocks in person, I am not sufficiently informed of the several circumstances of these facts, and therefore shall not detain the reader, but refer them to further enquiry.

N°. xxvi. Marsh-asparagus or sperage, *Asparagus palustris*, Ger^x. found growing on the cliffs at the Lizherd point.

N°. xxvii. Smooth-leaved rupture-wort, *Herniaria glabra*, found at the Lizherd Point plentifully by Mr. Ray^y.

N°. xxviii. Lesser autumnal star-hyacinth, *Hyacinthus autumnalis minor*, Ger. Park. found in plenty on the Lizherd Point^z.

N°. xxix. Rose-wort, *Telephium-roseum*, Mor^a. gathered also among the rocks at the Land's End, 1754.

N°. xxx. Our sands on the sea-shore afford some useful plants, SECT. VIII. of which the eryngo or sea-holly may be reckoned first; it is the *Eryngium marinum* of Herbalists^b: its root, for excellent syrup, and candying, is universally acknowledged to be a great restorative. It grows in greatest plenty on the loose dry sands, above full sea-mark, between Penzance and Marazion, and on the sands near Gwythien bridge, where the sea never reaches: it is also found in so many other parts of this county, that in this and samphire it is thought Cornwall exceeds any county in England^c. Having transplanted eryngo from the beach into a light, sandy, sunny part of my garden, I found it to thrive very well.

N°. xxxi. Along the sandy hills of the parishes bordering on the North-sea, as Philac, Gwythien, and Piran-sand, there grows a rush in the dryest and most naked sand-heaps, which I take to be *Juncus acutus capitulis Sorghi*^d. These rushes have a two-fold use;

* This mallow has a woody stem, as great as a man's arm, flowers and roots large, says Parkinson, ad malvam.

^x Ray, 3^d edit. page 267.

^y Ibid. page 160.

^z Ibid. page 373.

^a Ibid. page 269.

^b Ibid. page 222.

^c Carew, page 19.

^d Ray, 3^d edit. page 471.

their roots fix the sands, and prevent them from shifting with the winds, and consequently from making further encroachments upon the arable grounds; and the late Lord Arundel of Wardour, Lord of the ancient inheritances of the Arundels of Lanherne in this county, obliged his tenants of those parts (as his ancestors had done before) to plant a proper quantity of this *Fucus*, in order to preserve their lands from being over-run; the other use is, that the leaves serve the industrious women of these parishes to weave a kind of coarse mats for laying on floors, and mattresses for beds, market-baskets, and church hassocks, and very clean and wholesome they are.

N°. xxxii. Small sea-crane's-bill, *Geranium pusillum maritimum supinum Betonicæ folio*, found in sandy places near the sea, about Penzance and elsewhere^c.

N°. xxiii. Sea cud-weed, or cotton-weed, *Gnaphalium maritimum*, “on the gravelly shore between Penzance and St. Michael's Mount^d.”

N°. xxxiv. Creeping cock's-foot grass, *Gramen dactyloides radice repente, Ger^e*. “found by Mr. Newton on the sandy shores between Penzance and Marazion plentifully^f.”

N°. xxxv. Sea-dogs grass, long-rooted with a foliaceous ear, *Gramen caninum maritimum spica foliacea, C. B. (conoeidiā, foliis bifidis, sursum tendentibus)* Ludgvan garden, 1756^g.

N°. xxxvi. The English sea-pease, *Pisum maritimum Anglicum*^h, on the beach near Penzance.

N°. xxxvii. Narrow-leaved wild flax, *Linum sylvestre angustifolium floribus dilutè purpurascens vel carneis, C. B.* “in the pastures by the sea-side, about St. Ives and Truro plentifullyⁱ.”

N°. xxxviii. Small purple sea-spurge, *Peplis maritima folio obtuso auctorum, sive tithymalus*, found on the sandy beach between Penzance and Marazion plentifully^j.

SECT. IX. Being now on the brink of the sea, it would be an unpardonable neglect to omit the plants which our sea contains, emulating almost the number, if not the variety of those which live in the air, exceeding them oftentimes in fineness of texture, and beauties of colouring. Submarine plants are distinguished by the learned, into stony, horny or ligneous, and herbaceous. Among the herbaceous sea-plants, the most common kind is the *Alga, Fucus, Gras-wracks, Sea-wracks, alias Ore-weed*: Of this there is a great

^c Ray, 3^d edit. page 356.

ⁱ Ibid. page 391.

^d Ibid. page 180.

^k Ibid. page 319.

^e Ibid. page 399.

^l Ibid. page 362.

^f Ibid.

^m Ibid. page 313.

variety on our sea-coasts, of which the most curious that have reached my knowledge, for shape and colour, are,

N°. XXXIX. *Fucoides purpureum eleganter plumosum*ⁿ.

N°. XL. *Fucoides rubens variè dissectum*^o. Of both which plants the capillary ramifications are wonderfully distinct, orderly, and of a most beautiful lake-colour, even to the very extremities, when this *fucus* is in season; but when they are either immature, or on the decay, their extreme shoots are pale straw-coloured.

N°. XLI. *Fucus foliis Ericæ sive Tamarisci, vel Erica marina*^p, Tamarisk-Wrack, found in Cornwall by Mr. Moyle and Mr. Stephens.

N°. XLII. *Conferva marina, geniculata, ramosissima, lubrica, brevibus & palmatim congestis ramulis*^q.

N°. XLIII. *Fucus dichotomus parvus costatus & membranaceus*^r. Membrana-

N°. XLIV. *Fucus membranaceus purpureus variè ramosus*^s.

N°. XLV. *Fucus membranaceus purpureus latifolius pinnatus*^t.

N°. XLVI. *Fucus membranaceus rubens angustifolius marginibus ligulis armatis*^u, a plant of great beauty as to colour, but in shape exceeding all I have yet seen.

N°. XLVII. *Fucus membranaceus Ceranoides*; the Scotch call it Dils; the Irish, who chew it, Dulesh; found by the same^v.

N°. XLVIII. The largest and noblest plant of this membranaceous kind is the bloody sea-dock, *Lapathum marinum sanguineum*, or *Alga folio membranaceo purpureo Lapathi sanguinei figura & magnitudine*^x. When it is somewhat faded, the leaf is red variegated with straw-colour, not unlike that of a striped tulip; when it is in full season, of a rich perfect blood-colour, and so smooth and thin withall, that, when well displayed on paper, feeling can hardly distinguish it from the natural surface of the paper; and it sticks so tenaciously, that the paper may be folded or rolled, nay even plaited into the mount of a fan (as has been experienced by some curious ladies of this county) without any danger of the plant's starting. These membranaceous plants in general, though they retain their high colourings for years, (which shews how finely their colours are prepared and distributed) are indeed so extreamly thin, that a gentleman of my acquaintance, with no great impropriety, called N°. XLII. (viz. *Fuc. membran. purpur.*) the sensible *Fucus*; "for if brought near the fire just to warm, and not heat it too much, its edges warp up, and in this state, if a finger is moved towards them, they shrink from it, and recover their situation again when

ⁿ Ray, 3^d edit. page 38.

^o Ibid. d. N°. I. page 37.

^p Ibid. N°. x. page 49.

^q Ibid. N°. xxiv. page 61.

^r Ibid. N°. xx. page 44.

^s Ibid. N°. xxx. page 47.

^t Ibid. N°. xxxiv. page ibid.

^u Ibid. N°. xxxiii. page 47.

^v Ibid. page 46.

^x Ibid. page 47.

the finger is removed; placed on a hand tolerably warm, it keeps in perpetual motion to and from the hand like an animal struggling for life^y." Now this is at first somewhat surprizing, but is indeed entirely owing to the structure of these bodies, the plants being so very thin that they yield to the perspiration of the hand, the effluvia being of force sufficient to repel the leaves when they are near^z.

Latifolious
sea-wrack.

N°. XLIX. *Fucus sive Alga marina latifolia vulgatissima, vel Quercus maritima vesiculos habens*, the most common broad-leaved sea-wrack^a.

N°. L. *Fucus sive Alga latifolia major dentata*, broad-leaved indented sea-wrack^b.

N°. LI. *Fucus folio singulari longissimo lato in medio rugoso*, the sea-belt^c.

N°. LII. *Lichen marinus*, the laver, flauk, and by the Irish called Slukane^d. We have it with the green leaf, called Oyster-green; but the brown or auborn-coloured, is that which is prepared by being boiled to a jelly and stewed, then left to settle, and is eat as very nourishing in Wales and elsewhere: this is also found with us in plenty; but never yet, as far as I can learn, manufactured as in Wales. I have been informed, that the juice of laver pounded, taken three spoonfuls in the morning fasting for three weeks together, has been of great service in cancerous disorders; and that the cure of a cancer in the breast (with what foundation I cannot say) has been attributed solely to it^e.

Angustifoli-
ous sea-
wrack and
teretifolious.

N°. LIII. *Fucus angustifolius foliis dentatis*, narrow-leaved sea-wrack with indented leaves, found here by Mr. Ray^f.

N°. LIV. *Fucus Kali geniculato similis, non tamen geniculatus*, small-wrack, resembling glaſs-wort, found near the town of St. Ives^g.

N°. LV. *Fucus angustifolius vesiculis longis siliquarum æmulis*, narrow-leaved wrack with long pod-like bladders^h, near the Mount and Penzance.

N°. LVI. *Fucus folio tenuissime diviso siliquatus*, coddled sea-wrack with finely cut leaves, found by Mr. Moyle of Bake in Cornwall, and Mr. Stephens, 1694ⁱ.

N°. LVII. *Fucus teretifolius spongiosus parvus*, small, round-leaved, spongy sea-wrack^j.

^y Letter from the Reverend Mr. Griffith, F. of Pembroke College, Oxford, 1755.

^z Ifinglaſs, when spread very thin, will yield in like manner to the force of perspiration, ibid.

^a Ray, 2^d edit. page 2.

^b Ibid. page 3.

^c Ibid. page 6.

^d Ibid. page 10.

^e This relation came from a young lady who knew the person cured, and had the account of the cure from her own mouth.

^f Hist. page 71; edit. 2^d Synops. page 3.

^g Ray, 2^d edit. page 4.

^h Ibid. page 5.

ⁱ Ibid.

^k Ibid. page 5.

^{*} Ibid. page 4.

N^o. LVIII. *Fucus longo angusto crassoque folio*, sea-thongs¹. At the root or claspers of this plant there is a concave capsulous part, the use of which has not hitherto been explained. Mr. Ray^m calls it *Rotula latiuscula caulem prope radicem velut axem ambiens*. Happening to land on the Geer (a rock half a mile south of Penzance pier, covered with the tide eight hours in twelve) in search of Corallines with Dr. J. Albert Schloffer, F. R. S. a very curious and learned foreigner, in the year 1755, it was our fortune to see this *fucus* in its several stages of growth, but not one without this circular cavity. In some of them the sea-thongs were in their most infant state, the *gemmae* or first buds appearing no other than *papillæ*, in the center of the cup-like cavity, which in this state was very concave; in others the thongs were from an inch, two, three, and four, to four feet long, the *capsulae* becoming less concave in proportion to the size and age of the plant; by which different stages of growth, it appears, that this cup is the upper part, or first sheath of this plant, designed by nature to shelter and protect, by its cup-like cavity, the first tender buds of the *fucus*, till the strings within this sheath have gained a little strength and footing, sufficient to wade further into the sea, and by its flexibility able to elude the violence of the water: I will only observe farther, that though the sea-thong begins with a little bud no bigger than that of a *line* in diameter, yet it extends itself oftentimes to a great length: On the shore of Mount's Bay, in the month of July 1757, I measured some, and found them above twenty feet in length; they have also been measured in Falmouth Harbour, and found twenty-one feet in length. On the same shores with this *Alga*, are often-times found sponges, usually affixed to the rocks, shells, or sands; some of which are leafy, having their parts shooting into the shapes of curled leaves (as are those found on the shore near Loo); some are branchy, as the *Spongia ramosa*; some are solid oblong balls, which inclose a fishy embryo, *Spongia densissima spissa valida cinerea*ⁿ; some full of large round holes at the top of its tubercles, of a purplish colour when taken out of the water, but soon fading to that of common sponge; this sort has a cavity also underneath, as if some living creatures had nestled there, and used these holes as passages into the central cavity*; most likely it is a kind of crab which lodges its *fætus* in these spongy receptacles for their security, as Rondeletius intimates^o.

Many other sorts there are doubtless of the *Alga*, and many other submarines on the sea-shores of Cornwall; but it is now time to observe, that of these herbaceous sea-plants there are several uses. In

¹ Ray, 2^d edit. page 5.

^m Ibidem.

ⁿ Rondelet, page 134.

* Some think the whole sponge to be the work of insects, but however that be, the animals above-mentioned are adventitious.

^o Ibid.

islands of Scilly the sheep and black cattle feed upon sea-wrack, especially when the other pastures fail; and this they do, eating the plant in its saltiest state from the rock whereon it grows, when the ebbing tide has but just left it. That horses too will feed on it, with a little precaution, Plutarch^p relates, *viz.* when Cæsar followed Cato into Africa, his soldiers, for want of forage, were forced to give the *Alga* on the sea-shore to their horses, having first washed off the brackishness by fresh water, and mixed it with a little herb called Dog's-tooth. In the islands of Scilly, of the *Alga* they make kelp, a kind of imperfect vitrification of the salt, oil, and earth of this plant burnt together: they send it to Bristol to the glass-manufacturers; and in a fair dry summer, this article has been worth five hundred pounds to the Islands: but the most general use is for manuring the land; and there being so much sea-shore on the edges of Cornwall, this plant offers itself so conveniently, and in so many places after hard winds, that scarce any industrious farmer can want dressing for his land^q.

SECT. X.
Ligneous
submarines.

From the herbaceous, let us descend to the ligneous or horny submarines, of which our shores (not having been sufficiently examined) are thought to be destitute; but the warted sea-fan, Plate xxiv. Fig. 1. is a sufficient instance that such plants are natives of the Cornish shores, and are not to be rashly pronounced of foreign growth. It grew upon Pednankarn rock, two miles south-east of Mousehole pier in Mount's-Bay, in twenty-six fathom of water, whence it was plucked off by Andrew Harvey of Newlyn, fisherman, by his fishing-hook, in the year 1750: it measures fourteen inches wide by twelve high, and, as I am informed, has been found much larger in the same bay. It is the warted sea-fan of Mr. Ellis Hist. of Corallines, Plate xxvii, No. 1. the *Keratophyton flabelliforme cortice verrucoso obductum*^r.

The *flabellum veneris* has been found on the shores of Mount's Bay after a storm, but whether from a wrecked vessel, or torn off by the violence of the waves from some rock in the Bay, is not to be asserted positively; that we have plants of the same ligneous substance, and the same coralloid covering which incrusts all its branches, cannot be doubted.

SECT. XI.
Stony sub-
marines.
Corallines.

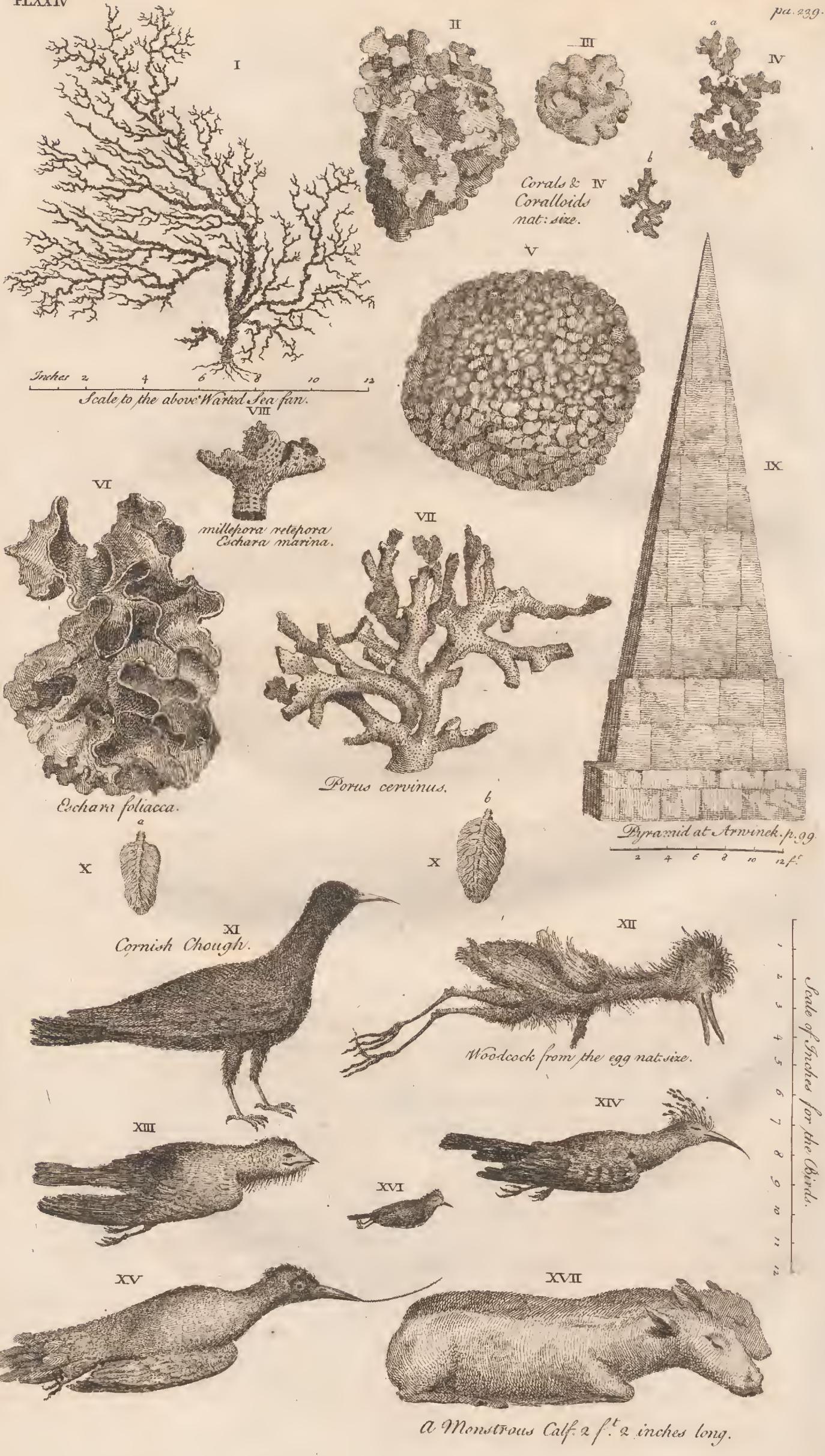
The stony submarines are either corallines, (sometimes called Coralline mosses) coralloids, or corals. There is a great variety of corallines on the Cornish shore, most of which, at present known, the ingenious Mr. Ellis before-mentioned, F. R. S. has taken care

^p In Cæfare.

* Observations on Scilly Islands.

^q See before of manures, page 86.

^r Ray, 3^d edit. page 32.



to describe most minutely. These coralline mosses are found affixed sometimes to *fucus*'s and shell-fish, but in their most usual situation to rocks, as a more firm settlement; here we find them sometimes in scattered tufts, at other times cloathing the rock on every side, and forming a piece of fringe-work equal in variety and strength of colours to the most beautiful carpet. The chief design of nature in overspreading the rocks and pools with such a number of Corallines, I need not observe was to be as well a shelter to the lesser fry, as nourishment to the larger fish (as we shall find in treating of sea-insects); but whilst nature is principally intent upon and pursuing the useful, it never forgets shape, arrangement, and colouring: its works are never barely useful; they are at the same time ornamental, neatly finished beyond conception or the natural reach of the eye, engaging, various, exact, coloured, abundant.

Of the more stony, solid, white corals, I have observed three different sorts. First, when it fixes upon stones, and involves them with incrustations, as Fig. II. Plate xxiv; this coral oftentimes resembles the foliaceous turns of the liver-wort, as Plate ibid. Fig. III. and is therefore called Lichenoides. In the second state, it consists of small knotty branches, connected or growing out of one another like a shrub, and may therefore be termed the sprig or branchy coral, as Fig. IV. a, b. Sometimes again it is found in globular lumps, in the middle more solid and compact than either of the former, the short sprigs which coat the outside diverging from the centre, and ending at the circumference in solid, fungoid, protuberances, as Plate ibid. Fig. V. Besides these ordinary appearances of white coral, we sometimes find it in much more uncommon shapes, as the *Eschara retiformis*¹, by Mr. Ellis¹ called the *Eschara foliacea millepora lapidea*, &c. It was found on the sea-shore betwixt Penzance and Newlyn, in the year 1755; the specimen here exhibited, Plate ibid. Fig. VI. is but six inches wide; I have been assured by a very intelligent fisherman, that he has drawn up one with his hook as big as an ordinary horse's head: they are soft and tender when first taken out of the sea, but soon harden and grow brittle in the air.

Corals have been also found on the same strand of the astroite kind, pierced with holes of the asterisk shape from bottom to top; the insect which either scooped out this coral to provide itself an habitation, or formed it as its shell, seems to have begun its workings at the base, from whence the principal or mother-worm rose almost perpendicular; these artificers made several offsets as they rose, which all diverge from the middle cavity, bending towards the sides of the

¹ Ray, Syn. page 31, edit. 3.

¹ Page 71. Hist. of Corallines.

corals : these masses are somewhat gritty on the exterior, but within almost as compact as ivory. Of the same kind are some with larger tubes, found, as well as I can recollect, on the sea-shore near Penrôs in Sithney, in the same bay. I cannot help adding here the *Porus cervinus Imperati*^u, commonly reckoned an Italian coral, but found in our seas. This rare coral, Plate xxiv. Fig. vii. was taken up by a fisherman at the Pole-bank, which lies two leagues south-west of Gilstone, Scilly ; at the same place was found the thin cup-like *Eschara*, Fig. x. which is the *millepora Retepora Eschara marina* of Ellis, Plate xxx. d, page 53.

Coral in general.

All these, as well as the corallines before-mentioned, and the fossil corals also (such as the brain-stone and the like, of which Cornwall yields none that have reached my notice) are radically composed of the same substance ; all shells also (as well of land-animals of the testaceous kind, as of fishes), the eggs of birds, and even the pearl itself are but finer pieces of workmanship of the same materials, raising the same effervescence with *aqua fortis*, but of different colours, different degrees of purity and consistence, and different shapes. It may not be amiss therefore to trace this submarine general compost, as far as it is found in sea-productions, through some of its most obvious metamorphoses. Coral is a calcareous substance, sparry (more or less) and argillaceous, partly extracted by the sea from the *strata* which it washes, and partly owing to the putrefaction and dissolution of the parts of dead animals, chiefly of the testaceous kind. In its most minute state, it nourishes sea-plants and animals ; it furnishes a glue and earth to the testaceous fishes, enabling them to form their own shells : as it floats in the waves in a less diluted and pulpy state, it is sometimes born up by tempests, and dispersed over the face of the ground, either by its salt and limy particles, warming and fertilizing both corn and pasture^w, or fixing and concreting the sand of the sea-shore into stone^x. When larger associations are formed, they are precipitated by their own weight, and the impulse of the sea-water : what subsides thus, if it meets nothing in its descent, rests as a sediment in the more sheltered parts of the bottom of the sea ; if it fixes in its way down, it serves as a basis for other *nubeculae* of the same sort to form themselves upon, arresting the little bead-like calcareous substances which come within its sphere. Hence some of the incrustations on stones and sea-wracks ; for it is plain that coral, when unimpregnated with active salt, seed, or egg, must fix like earth in a humble prostrate position, as an incrustation only, Fig. ii. Plate xxiv ; if agitated by the waves, then it folds itself into a *Lichen*-like foliage, as Fig. iii. ibidem ; if, whilst it swims

^u Ellis, page 72.

^w See page 84.

^x Page before, 95.

at large it meets any ligneous plants, it sticks and coats them round as we find by the sea-fans; but if this shell is not the plain consequence of the adhesion only of these particles, but the work of animals, and is accumulated round them by millions of sea-insects, which fix their shells so close to one another as to form a compleat case to the branched substance which they inclose, it is much more to be admired; if it picks up any seeds, we can easily imagine that by its fertilizing nature, it may feed, expand, and nourish these seeds into mosses and corallines; if it meets with the *ovaria* of insects, it serves as a nidus for them to grow in, and a shell afterwards (which may possibly be formed by themselves) where they alternately hide themselves for safety, and whence they extend themselves for nourishment. Of the sprig-coral, (if it be not the fabrick of animals, as some learned men contend) its branch-like shape, though so knotty and short stemmed, may be owing to vegetation (as from its figure is usually suspected); but if, according to others, it grows only by *juxta-position*, these short stems are rolled into a cylindrical form by the sea, brought into contact before their soft jelly parts are hardened, then knotted together, and their interstices filled more or less in proportion to the quantity of coral with which they chanced to coincide. I shall not list in this dispute, but whether in justice to the gentlemen who think corals the fabrick of animals, I must observe, that the escharæ, Plate xxiv. Fig. vi. and viii. tho' curled and folded in such a leaf-like manner, are no more (as it seems to me) than thin, and very orderly assemblages of the shells of animalcules: the fasciated coral^r at its first beginning is no more than so many tubular sheaths or shells of insects; they are connected gradually by other insects which stretch their coatings in transverse lines from tube to tube, gradually filling up the spaces between, as in Plate xxvii. Figure vii; and in time this bundle of sheaths is formed into a solid coralloid astroite, where the first and largest tubes still appear, with their openings asterisked as in *madrepora poris stellatis* of Linnæus (Syst. Nat. Tab. vi. Figure viii). The *Tubipora* (Fig. vii. ibid.) consists of smaller tubes placed closer together and connected, formed cylindrically by a smaller and different animal. The *Millepora* (Fig. ix. ib.) is pierced with holes, and scarce visible to the naked eye; the tubes probably of more diminutive insects; and our sprig and branch-coral may possibly be the fabrick of still smaller creatures, though to the eye no more than imperfect, uninformed vegetables. I would observe farther, that the testaceous animalcule which proceeds out of the *balanus* shell, (Linnæ. ib. Fig. iv.) has sixteen legs or claws jointed

^r Lhuyd's Lithoph. N°. 104.

or articulated in the same pliant manner as the branches of mossy corallines are ; this might make one conclude, that as nature in some vegetable instances approaches nearly to animals, so in many of her lower animals she approaches nearly to the shape of vegetables ; the space between both kingdoms is narrow, the transition easy, and scarce perceptible ; and it seems not to be unlikely, that some insects should consort, and construct their nidus's in the plant-like form, because it is indeed more suitable, upon many occasions of food and security, to the exigencies of the medium they live in. This is no more unlikely, than that the spider should spin her web to transmit, bend, yield to, and float in the air, and bees conform their combs to the holes and hives allotted them. Instinct is a fertile monitor, and can suit her lessons to the occasion of her disciples. But to return : The coral substance is most perfect for polish and beauty, when most stony and close-grained ; but the coral of the Cornish sea-coast, in its finest state, is of a coarse grit compared to the oriental ; as to polish and hardness greatly inferior ; yet, as a manure for land, I should think much preferable, being by experience found excellent in its kind for this purpose. Some of our coral is white as new-quenched lime, some cinereous, other brown yellow, according to the materials of which they are composed ; for in the brown yellow more especially, the specks of clay and stone which give it that colour, may in the microscope be plainly seen.

C H A P XXI.

Of Birds.

FR OM vegetable, inanimate, and doubtful productions, let us rise now to sensitive life : Of birds found in Cornwall, some are perennial, others migratory. Among the first may be reckoned the hawks, of which we have several sorts ; the marlions, sparrowhawks, hobbies, and in some places the lannards² : In the reign of Elizabeth, the Cornish and Devonshire gentlemen employed a great deal of their time in hatching, nurturing, and instructing them to fly at the partridge³ : In Cornwall at present this tedious science, which consumes so much of life for so little an end, is now no more, but still exists it seems in a neighbouring island ; for being at Trerice (the seat of the present Lord Arundell of Trerice) August 25, 1738, I saw a hawk which, being overpowered by a crow, fell near a man at his labour in the field, who, perceiving the

² Carew, page 25.³ Ibid.

hawk

hawk quite spent, brought it into the house to a gentleman then steward to his Lordship. The hawk was armed as usual with silver plates on its legs and neck, and Mr. Church (so the steward was called) perceiving an inscription engraved, quickly discovered the name of an Irish gentleman, and the place he lived at; upon this he took great care of the hawk, and wrote immediately to the gentleman: The bird was a favourite, and the gentleman sent a servant from Ireland into Cornwall on purpose to fetch it.

Among our Cornish birds, the coracias of Willughby, or the ^{Cornish} pyrrhocorax, deserves principal notice. It is found but rarely and ^{Chough.} at times in other countries, but constantly in this county, and therefore deservedly among the moderns it has obtained the name of the Cornish Chough. Pliny (lib. x. chap. XLVIII.) thought it peculiar to the Alpes, but Aldrovandus (lib. XII. chap. VIII.) informs us, that it is only seen there among the Rhæti in the winter: It is found also in the island of Crete, in the Cyclades, on the sea-coasts of Cork in Ireland, in Wales, and elsewhere: there is a pyrrhocorax in Africa called the Crow of the Desart, but bigger than our raven, and therefore called the larger Coracias^b. To the faithful description of this bird in Ray's Willughby, page 126, nothing need be added; as to its defects and merits, something, and not improperly, may. It is taken much with glitter, very agile and meddling, and therefore not to be trusted alone where fire, money, or papers of consequence lye; but in both these particulars, as I have often experienced, not near so mischievous as the jack-daw, (the monedula of authors) whose faults by mistake have been too often imputed to our chough; a great enemy to houses covered with thatch, the moist and rotten parts of which, by its long bill in searching for worms it disperses, and quickens the decay; it will also pick out the lime-pointing of walls in search of spiders and flies. These tricks have procured this bird a bad character; Camden calls it *incendiaria avis*, and Mr. Carew, page 36, the slander of our country; but certain it is that our ancestors thought of it (and very deservedly too) in a different manner.

Upton, who writ *de re militari*, about the middle of the fifteenth century, observes to the praise of the Cornish, that some of their most ancient families bore these birds in their coat-armour^c. Now, to shew that these gentlemen made no contemptible choice of their bearing, it must be remembered, that the Cornish chough is the most graceful, slender, and genteel of the crow kind, for which

^b Shaw's Trav. page 251.

^c Sic ergo in laudem gentis & patriæ Cornubiensis (quæ gens rectè a Trojanis traxit originem & ab imitatione ut creditur, adhuc perseverat) qui-

dem antiquissimi nobiles ipsius patriæ istas aves in armis suis portant, quæ quidem aves [graculi scilicet quæ in rostris et tibis rubescunt] specialiter in illâ patria sunt repertæ. Edit. Byss. p. 195.

reason

reason I give it, Plate xxiv. Fig. xi. in another and more extended attitude than Mr. Ray's Willughby in his nineteenth Plate; its legs, toes, and bill of a strong vermillion, and the bony substances of these parts clear even to transparency: they are always yellow when the bird is young, and in the hen yellower than in the cock, which different colouring probably made Aldrovandus by mistake (as in Willughby is observed) think those with yellow feet, legs, and bill, to be a different species from the coracias with red feet¹: its feathers are of a much richer velvet black than those of any other crow. It is said, that, having its tongue slit when young, it will thereby be enabled to imitate the human voice, a property which Bellonius also ascribes to this bird²: this is certain, that as it shrieks aloud at the approach of any thing strange, frightful, and unusual, its chatter is extremely soft and engaging, when it applies for meat, and makes its court to those who usually feed and fondle it: its strength lies in its bill and neck, rather than wings; it is not therefore so warlike in the air as other crows, but on the ground it is very pugnacious, whetting and darting its bill, and though as tame as may be, not admitting any stranger to touch him. Very apprehensive of danger, it builds its nest in the cliffs, but neither in the top, as if all danger was from below, nor near the bottom, as if all its fears were from above, but in the middle of the most steep precipice; very amusing when kept tame; docile, regular, and constant to its hour for meat; early at roost; in bad weather fond of shelter and seldom seen; but presaging good weather, it enjoys the air on the tops of houses, if tame, if wild, strutting stately along the hills or greens by the sea-side.

Wild-birds.

Of singing-birds, we have thrushes, the black-bird, throstle or song-thrush, and the much larger and better coloured missel-bird or shrite, (the *Turdus viscivorus major* of Willughby, page 187) which we call in Cornwall the holm-thrush; the Cornish call the Holly-tree, Holm, and this the holm or hom-thrush, because, as I imagine, in the winter it feeds upon holly-berries, each bird taking possession of his tree, keeping constant to it, as long as there is fruit, and driving away all other birds. (See Ray's Willughby, page 187). Our linnets are either green or brown; we have gold-finches, ruddocks, nopes or bull-finches, and larks. Nightingales I have not seen, or heard of any in Cornwall.

Of wild-birds, driven here by the extremity of the weather, we have all sorts.

----- *Ad terram gurgite ab alto
Quam multæ glomerantur aves ubi frigidus annus
Trans pontum fugat et terris immittit apricis.*

¹ Aldrovandus Ornith. lib. xii. chap. viii.

² Virg. Æn. lib. vi. ver. 310.

Ducks of all kinds, the true wild-duck breeding in the marsh betwixt Penzance and Marazion; widgeon, teal, woodcock, snipe, &c. The shell-drake (*Tadorna Bellonii*) is rare, but in the hard winter 1739, I had one brought me exactly answering the description of Ray's Willughby, page 363, Tab. LXXI.

Of the common periodical or migratory birds, "the swallows in Migratory the winter are found in the western parts of Cornwall, fitting in old deep tin-works and holes of the sea-cliffs," says Mr. Carew, page 26. This is a circumstance questioned by some Naturalists, and as confidently asserted by others; the truth is, when the winter comes on, and the air is no longer replete with the flies and insects which are the swallow's proper food, this bird disappears; some perhaps may pass into other climates, or die, and others remain in a torpid state in private caves, some under water, and some above. The red-wing or wind-thrush, in Cornwall called the winnard, and fieldfare, are most common when there is most cold, in gentle winters few or none. The Royston crow, with the black bill, head and wings black with a glossy blue, the breast, belly, back, and neck cinereous grey, shafts of the feathers blackish, continues with us from October to March, but generally on the sea-shore, and betwixt Penzance and Marazion, fond of the products of the beach, though usually reckoned granivorous.

Woodcocks are reckoned birds of passage, but they do not always leave the country to which they occasionally resort: Some gentlemen, hunting in the neighbourhood of Penzance, in the summer-time 1755, flushed a woodcock; surprised at seeing such a winter bird at that season of the year, they hastened to the bush, and there found a nest with two eggs in it: a gentleman, more curious than the rest, carried the eggs home; and one being accidentally broke, the body of a young woodcock appeared, and encouraged him to put the other egg under a pigeon, and in a few days a living bird was discovered in it with its feathers on, in shape and size as in Plate xxiv. Fig. XII. page 239. Snipes also, young and from the nest, are often flushed on Bodman downs.

As it is my design in this history to represent whatever is rare and Rare birds. worthy notice, as well as what has not been thoroughly described by others, I shall not omit an uncommon bird caught at Mousehole, and brought to me Sept. 23, 1755; the great noise it kept in the night, the smallness of its bill, the disproportioned largeness of the mouth, and the unusual shortness of the legs, made me take the following measurements: From the point of the bill to the extremity of the tail, ten inches; from the tips of the wings extended, one foot nine; its bill flattish, thin, and only three tenths of an inch long, somewhat curved; the spread of its mouth very large, being two

inches and a half from the tip of the upper to that of the under mandible distended; the mouth ruddy-coloured within, and its depth a full inch and a half; from the point of the bill to the hinder part of the head, one inch and a half; the eye was black, and large in proportion to the bill; the neck to the pinion of the wing, one inch and a half; from the pinion to the tip of the wing, seven inches; the tail five inches long, consisting of ten feathers equal in length; four toes, the middle one seven eighths of an inch long, legs only five eighths; foot not webbed; its colour was betwixt that of a sparrow-hawk and a woodcock, but the ground of the whole somewhat more inclining to a black: the weight of this bird was two ounces and a half, four penny-weights and two grains. It is very quiet and torpid by day, but noisy and clamorous by night. Our common people call it the Night-crow; I take it to be the fern-owl of Shropshire, called the churn-owl in Yorkshire from the noise it makes when it flies, the goat-fucker, the caprimulgus of Ray, Syn. page 2 and 26. Ray's Willughby, page 107. I have given a drawing of this bird Pl. xxiv. Fig. xiii. where, every part being done by measurement, it may give some parts more exact (or more particular at least) than that in the fore-mentioned author, Tab. xiv. It is found mostly in woods and mountainous places, in the Peak of Derby, in Yorkshire, and Shropshire, and some other places, but rarely in Cornwall.

The sheld-apple or cross-bill, as Mr. Ray calls it, (Synops. page 86) or shell-apple, as Dr. Plot, (Staffordshire, page 234) is seldom seen in Cornwall; but in Mr. Carew's time, a flock of them coming about the time of harvest, made great destruction among the apples, Car. page 26. In the autumn they sometimes, though rarely, come into England, but never continue the whole year, or breed in our island.

The upupa, hoope, or hoopoe, Plate xxiv. Fig. xiv. was killed in the parish of St. Just, Penwith, in Cornwall: In some particulars it differed from Mr. Ray's Willughby; there was no red in its neck, all of a light chesnut; the eight first feathers of the wing, as to the ground, quite black; five were crossed or barred, the other three spotted near the summit with white; the remaining feathers crossed with five white bars; the upper covering feathers of the wing not so black, but inclining to the chesnut; the rest as in Mr. Ray's Willughby, page 145. It was near the bigness of a snipe: it is rarely seen in Cornwall.

The green wood-pecker, or *picus Martius*, is a beautiful bird, remarkable for its vermillion crown on the head, and the different shades of green in its body and wings, which rise from a deep mixture of brown through four intermediate tints, till it ends in a fine light

light-pink yellow. The structure of the muscles by which this bird is enabled to dart forth its tongue upon insects, (its proper food) and recover it again into its sheath, is admirable, and may be read at large in Ray's Willughby, page 136: the legs are very short but strong, and the toes stand two forwards and two backwards, enabling them (suitably to their determined course of life) to climb trees, and fix their footing firmly on boughs, to which also the stiffness of their tail-feathers not a little conduce. Ray's Creat. page 143. The present specimen, Plate xxiv. Fig. xv. was killed at Godolphin, October 11, 1757.

The golden-crowned wren, *Regulus cristatus Aldrovandi*, wood-titmouse of Gesner, (Ray's Willughby, page 243. Ray's Synops. av. page 79) the least bird I have yet seen in Cornwall, remarkable for its beautiful saffron-coloured and scarlet crest, and smallness of its body --- By the scale of the rest, Plate xxiv. Fig. xvi.

The Pittrel (Catesby, Append. page and plate 14) or little Peteril of Edwards (page and plate 90) is sometimes met with here, as may be seen Plate xxix. Fig. x. in the explication of which it will be further taken notice of.

Of water and sea-fowls, that we should have a great variety in Cornwall is no wonder, considering the great extent of our shores. Here we have coots, sanderlings, (which, from the noise they make when flying, we call Towillees^f), sea-larks, sea-pies; of puffins great abundance in their season, and extremely fat, but of so fishy a taste, that some have salted them to eat as fish^g; all sorts of gulls, mews, tarrocks, gannets, murres, heron, bittern, lapwing, curlew, bernacle, shagg (in the north called the Crane, says Mr. Ray, Syn. page 123); we have also the didapper, to whose instantaneous plunge into the sea after its prey, Virgil so well compares the descent of Mercury from Heaven to Carthage.

*Hic primum paribus nitens Cyllenius alis
Constitit, hinc toto præceps se corpore ad undas
Misit avi similis quæ circum littora, circum
Piscoſos scopulos humilis volat æquora juxta.* Æn. iv. ver. 253.

Of miscoloured birds, I have known a white thrush, (the *Merula vulgaris*, Ray's Willughby, page 190) kept for some time. It was living in the year 1724, in the possession of John Bennett, blacksmith, of Ludgvan; a white ruddock, or robin-red-breast, in the possession of the late Reverend Mr. Collins, vicar of St. Erth, in 1754; but I shall be more particular in noting the deviations of a white woodcock's feathers: It was brought to me January 1, 1739; at the insertion of the bill it had a small cinereous tuft of feathers

^f Not Curwillett, as in Mr. Ray's Syn. page 109, 2^d edit.

^g Car. page 36.

half

half an inch high, as much broad, and sloping down on each side to the bottom of the upper mandible;—from thence, the head, neck, wings, and all the other parts, were of the finest snow white, saving three small specks on the crown of the head, of like colour to the feathers of other woodcocks, in the same place: In the breast and neck it had nine separate feathers tinged so faintly as scarcely to be distinguished from white, but of the natural wavy mark: in each wing it had one principal feather, and four seconde-rate of the natural colour; in the right wing six specks on the smallest feathers, in the left wing too; in the upper part of its tail two natural feathers, in the under, one, but in both of very faint colouring; the belly, and under parts of the wings near the *scapula*, tinged with a few faint natural feathers; the legs a little redder, and more of a flesh-colour than in the common bird. This description is of no other use than to shew that this bird was originally coloured as other woodcocks, and that such departures from nature proceed from some accidental defects, extravasation, or obstruction of the juices, occasioned by either excessive exercise, wound, or unwholesome diet; but by which it is impossible to determine.

The eggs of sea as well as land-fowls are variously shaped and spotted, making a pretty collection; and a little attention will shew that not only the eggs of the different *species*, but that the eggs of individuals of the same *species* are really different in shape, size, and colour, insomuch, that the eggs of particular hens may be distinguished from each other, and known (without regard to the nests) from what hen they did proceed. Eggs owe the unnatural defects and excesses to which they are subject (such as a yolk perfectly white, an egg with two whites, preternatural membranes and excrescencies adhering to the egg, and the like anomalies) to a variety of accidents tedious to number, and difficult to ascertain.

C H A P. XXII.

Of Land and Water-Insects in Cornwall.

SECT.I. **T**O trace insects through their respective differences, their transparent structure, rich colourings, peculiar instincts and transformations, would much exceed the limits of the present design. Mr. Ray thinks that there are more sorts of insects than of birds, and acknowledges the multitude of the *species* of insects not to be fewer, perchance more than twenty thousand^b.

^b Page 24 of the Creation.

In Cornwall, likely, we have more of those insects which require Their use, moderate warmth, sooner and longer in the year, than in other parts of England where their colds and heats are more intense. I shall not dwell much upon particulars, but in general observe, that as little as these creatures are, many undiscoverable to the naked eye, some scarce to be seen by the best constructed glasses, they have their use, and their necessary station in the animal scale; the smallest are food to larger, the larger to others of a greater size, and these to the greatest; these again to birds and reptiles afford nourishment, and some of them provide food, and physick for man; nay the very smallest insects sucked in imperceptibly with the air we breathe, by their better concocted animal juices, may serve to qualify and correct the acrimony of air, and thereby contribute to the spirit and rectifying of the blood; add to this, that the smallest insect as justly raises our admiration, and as directly leads us to a first intelligent cause, as the structure of a planet or the fabrick of the universe. By their inconceivable numbers, these small creatures are the great instruments of divine justice, and are either the vehicles of pestilence, or by their voraciousness bring scarcity, famine, and destruction upon a guilty land.

Useful as these diminutive creatures are, they must have their al-^{Food.} lotted food; this food is usually the leaf of flower, herb, or plant; hither in swarms they tend, fix, and eat, and nestle their eggs; and when their multitudes are increased by wind or weather, consume the bud, the blossom, or fruit they light upon. Blights therefore in the nursery, fruit, and flower-garden, may with great justice be oftentimes ascribed to swarms of voracious or poisonous insects, but I apprehend not always; the air itself being oftentimes charged with corrosive steams and noxious humours, is of a very caustick nature, and frequently scorches and shrivels the sap-vessels, and brings on decay. Howcver, there are few plants which do not at one time or other suffer in some degree from insects; nay, exoticks though they come from another climate, and one would think should have been the appropriated food of exotick insects, do not escape those of this climate. August 20, 1750, finding the leaves of an orange-tree spotted as if mildewed, on viewing it more attentively I perceived on each spot an orbicular substance thin as the leaf, of one tenth of an inch in diameter; and upon examining it in a microscope, it appeared to be crustaceous, in shape, colour, and transparent spots on the back, resembling a tortoise; the belly-part soon confirmed it to be an animal; the edges of the shell were thick set with bristles, by which I imagine these animals fix themselves to the leaf on which they are disposed to feed as well as fence themselves from their enemies: besides these marginal appendices, they

Instinct.

have legs four times as long as the bristles ; there were no wings that I could perceive ; but I do not assert that there were none : the leaf turns black in the place where this insect fastens . Possibly this may not be a non-descript ; I only produce it as an instance that the discolouring and decay of leaves, even in exoticks, is owing sometimes to unobserved insects. Among the numerous tribes of insects which have employed the attention of the curious, it is wonderful to observe, that every *species* has a different art (if I may so call the impressed instinct) of procuring its food, and preparing proper receptacles for its different states of caterpillar, nympha, and fly : among them the spider cannot be sufficiently admired for extracting its threads out of its own body ; sometimes it fixes, and makes that thread either its streight rope to convey itself from one post to another, or by its extended surface spins the thread so much lighter than the air, as to float and bear up its author, till she finds a place to fix in proper to her designs ; at other times she weaves the same thread most artfully into nets or webs for intercepting and fettering her prey. Still more admirable, as well as useful, is the bee ; the frugality of space, the uniformity of shape observed in the construction of the cells and combs, her delicacy and choice of flowers which yield the best honey, her laborious collection of wax, the œconomy, policy, colonies, and the general abhorrence of laziness of this little insect, are all evidences of an instinct, which (if it may not be called reason, circumscribed, and applicable solely to the exigencies of one particular *species*) is the stamp, the seal, the impression of reason from above. By the greatest, strongest, stateliest animals of the brute kind, we have no where a richer treasure collected than that of the bee, more skilfully composed, a magazine more carefully secured, and more impartially distributed. But to return : The honey of Cornwall is reckoned good, and of a high flavour, as I have been informed by gentlemen of sickly habits, who have preferred it to most English honey : this excellency is perhaps more owing to the multitude of our shores, where the bees are frequently seen intent upon the salt and brine which the sea throws in upon the rocks, than to the nature of our heath and other pasture^k. Of late years the burning-houses, where the tin is roasted^l, prove fatal to bees ; those that are within reach of the smoke languish, and are soon killed, having no liberty to range as the wind and variety of food determines them, without danger of suffocation.

ⁱ It seems of that kind which Mr. Hill calls *Scelafius*. Hist. of Animals, page 10.

^k It is observed in Hampshire, as I have been informed, that the honey collected from the heath

is but half the value of that which is gathered elsewhere.

^l See page 134.

The number of water-insects is probably so much greater than that of land-insects, as there is more need of animal food (the chief end perhaps of such beings) in such a turbulent medium as water, than upon the land, where plants and seeds, and other nourishments of animals, are not so often destroyed, as in the sea, rivers, and lakes, which are subject to more violent motions. The multitude of these little animals is beyond conception, of which I shall produce but one illustration, which is, that the shining of the agitated surface of waters is most probably owing to a multitude of lucid animalcules, a phænomenon which, under this head of water-insects, must not pass unnoticed. It has been long observed, that “ if the sea-water be flashed with a stick or oar (as Mr. Carew, page 27, says) in the darkest night, it will cast forth a bright shining colour, and the drops resemble sparkles of fire, as if the waves were turned into flames;” this surprising appearance the Cornish sailors term Briny, and think it presages a storm; but it has no connexion either with a tempest or a calm; it is indeed the usual consequence of agitating the surface of the sea, though in different degrees in different places, and different seasons of the year^m; in the summer “ so very luminous in strong gales of wind near the ifles of Cape Verd, that passengers have seen the very keel of their ship by it, and fishes playing underneath *.”

We shall best be able to discover the cause of this surprising phænomenon, by tracing the same effect into different subjects, and placing the several circumstances relating to it under one view; for the same phænomenon has been observed by the curious in waters of lakes and moist places on the land, as well as in the waves of the sea. Dr. Plot mentions this luminous appearance in a moist spungy earth on a hill and in a ditch in Staffordshire, where the water, being disturbed, shined like embers, and covered whatever they touched with a faint flame like that of burnt brandy, which continued shining for a quarter of an hour †.

Dr. Cotton, May 25, 1664, gave the following account to the Royal Society of the like appearance in this County of Cornwall: “ Returning from Lanceston with Sir J. Coryton, Baronet, to his seat Newton, in a misty, dewy night, at Hinzen, almost a mile beyond Callington in the Lanceston road, in a moorish place of some forty feet in length, the impress of our horses and our own feet upon the ground appeared fiery, much more fiery than glow-worms; the grass we gathered in those places where we or our horses trod, reserved the lustre in our hands, eer we came to the water within a quarter of a mile of Callington, where watering our

^m “ In the summer months it is most visible when the wind is south-east, or in any point betwixt south and east,” says Dr. Plot, Staffordshire, page 117. * Ibidem. † Ibid. page 115.

horses

Sea and wa-
ter-insects,
and their in-
finite num-
bers.

horses we observed it, but almost extinguished, only a spark here and there. At Newton, two miles thence, we viewed it by candle-light, as also the next day, and found it coarse, spiry grass, of an inch or little more in length, such as ordinarily grows on downsⁿ." The cause of this luminous appearance has been variously assigned; some have thought it owing to a certain bituminous matter thrown up by a fermentation, or steams ascending from the bottom of the sea^o: But this is too limited a cause, and will by no means account for like appearances by land; indeed nothing of a bitumen appears, neither do waters of any kind become luminous unless first stirred and agitated, neither does kindled bitumen make so harmless a fire, nor continue shining so long, nor expire so gradually. Others have thought it part of that electric fire, which (as every one is now convinced) is diffused throughout the universe; but this electrical fire becomes only visible by flashes, passing in instantaneous fallies from one body to another, and immediately expiring; and a learned gentleman* (as I am informed) who had formerly espoused this cause, concludes ingenuously from farther experiment, that this luminous appearance is not owing to electric fire produced between the particles of water and those of salt, as he had first imagined, but to some other cause.

Dr. Plot (Staffordshire, page 116) hints, that the shining of the mire and miry water, may be owing to a kind of glow-worm; thus the clammy moisture of oyster-shells which shines in the night of a violet colour, comes from luciferous worms that have their holes in the shells^p; and this hint has been adopted, and farther pursued by some modern authors of reputation^q, who are of opinion, that this shining light is owing to a multitude of animalcules rising to the surface of the sea in the night, and throwing forth their light (like glow-worms) when they are agitated. This hypothesis is confirmed by the late experiments of a learned Italian, Dr. Vianelli of Chioggia, who carrying home a vessel full of the luminous water of the lake of Chioggia, and stirring it in a dark closet with his hand, found that it glittered much; but after filtrating it through a piece of coarse linen, that it shone no more: the piece of linen however was covered with lucid particles, which in a microscope he discovered to be animalcules entirely luminous^r. In all the forementioned cases of mire, lake, and sea, there is none of this shining without water stirred: it is therefore an aquatic glow-worm^s of a different element from that of the

ⁿ Dr. Birch's Hist. of the R. S. vol. I. pa. 431.

^o Natural History of Waterford, page 290.

^{*} Mr. Franklyn.

^p Ibid. from Mr. Auzout.

^q Mr. l'Abbé de Nollet, and others.

^r Since Vianelli another Italian author, Dr. Grifelin, has pursued and farther elucidated the same subject.

^s It is called *Nereis phosphorans*; alias, *Scolopendra marina lucida*.

land,

land, not dispersed equally in all waters, but more or less in particular parts of land and sea-water; that they do not shine without being agitated by the treading of horses or men, or by the force of oars, rocks or ships, is because, when at rest, they mutually hide the luminous juices of their body, juices which shine in the dark, but cannot make that shining visible till the throng is somewhat dispersed, and the disturbed insects have room to exert and display their lustre. Why none of these waters shine in the day-time is obvious, the light of these little creatures has not force sufficient to make itself perceptible among the solar rays; perhaps too, these insects rise to the surface of the water by night, and there gather themselves together as the proper season for assembling. Lastly, that this harmless fire faints, and gradually expires in an hour, is owing to the death of these animalcules for want of their own element; they shine not after death.

If then this lucid appearance is owing to insects, we cannot but admire the immensity of this order of creatures, and revere that infinite fertile power which (to say nothing of what we find by land) has spread over the surface of the sea such a profusion of animal life, couched in such contracted and yet splendid bodies, that in one bay or creek there are insects more in number likely, than all the quadrupeds upon the face of the whole earth.

But from the number let us come to some of the most remarkable and larger sorts, among which the sea polype may challenge our next notice. Polypes are found in great number and variety inclosed in alcyoniums, corallines, corals, (Philosophical Transactions of 1751 and 1752, vol. XLVII. page 101) marbles, and other stones¹; and, if I mistake not, in some branchy *fucus*'s; for when they are fixed to the rock on which they grow, they have a most beautiful blueish purple at the extremity of the branches, but taken out of the water, appear of the brown common sea-wrack colour; which alteration for the worse, I attribute to the polypes, or some other animalcules contracting themselves into their own cells as soon as they are taken from their proper element, and refer to further enquiry. In short, there is scarce any plant or soft stone in the sea without some polype or other in it, nature having provided those creatures which have less of the locomotive faculty, with longer and more flexible tubes, and numerous feelers to reach after and apprehend their prey, than those which can ken, pursue, and overcome it.

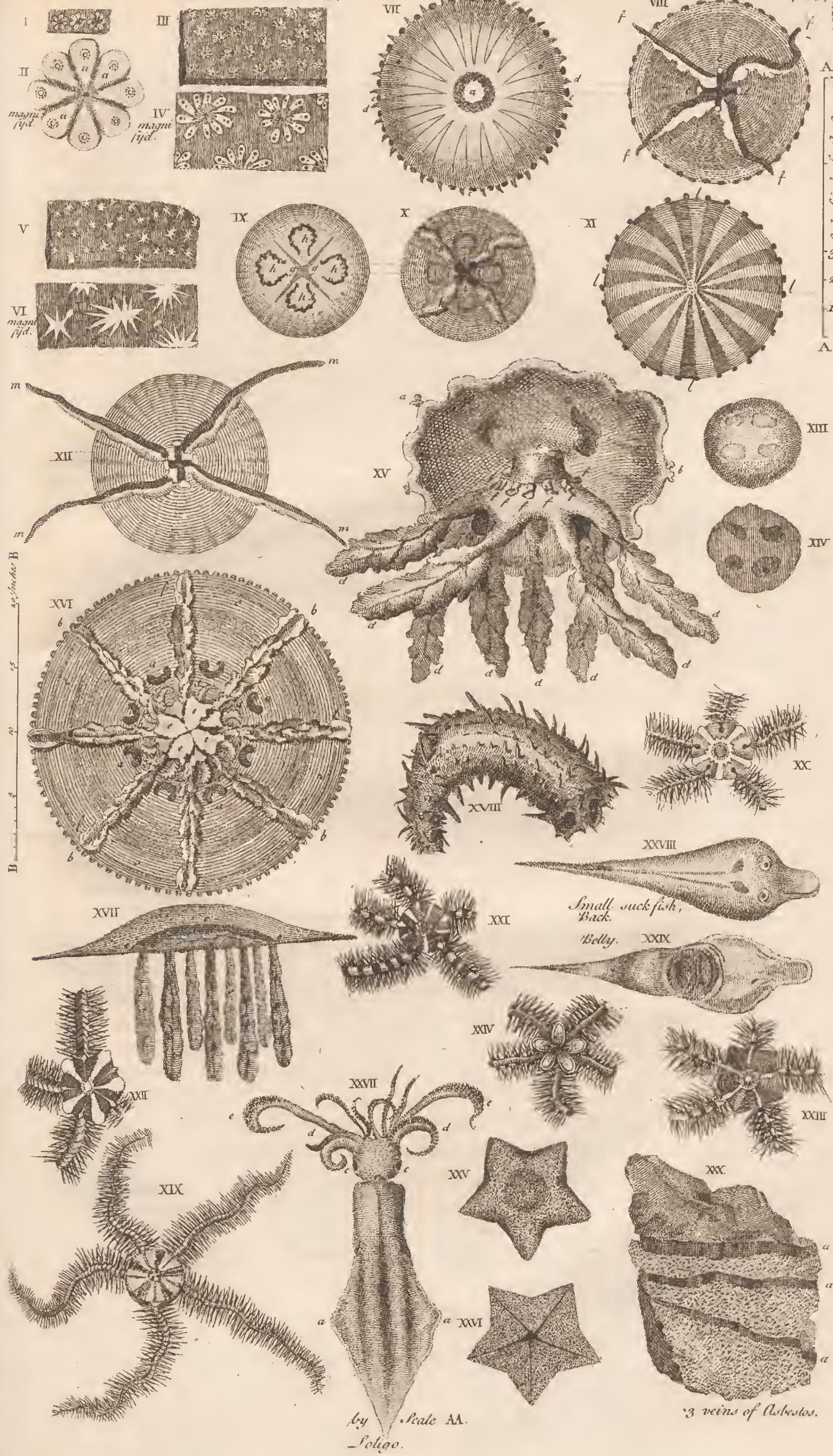
I shall next take notice of some zoophytes (whether polypes or not, perhaps may be questioned) which have reached my notice in

¹ Ibidem ut supra, page 68.

the alcyonium and the coralline. The alcyonium is of a middle nature betwixt the herbaceous and horny submarines; its substance fleshy, and sometimes hard even to cartilaginous; shapeless at times; sometimes tubular; generally inhabited by animalcules. Dr. Schloffer before-mentioned discovered one of a curious make dredged up in Falmouth Harbour, September 18, 1755. The alcyonium was brown and thin, and was the *ground* in which the animals had placed themselves in ranks, each in a rose-like shape, making a kind of border round the stem of an old large *fucus*. The natural size of the flowers (of which there are three placed side by side) may be seen Plate xxv. Fig. i; one is magnified, as Fig. ii; each rose had from five to twelve, but more generally eight leaves, each leaf an aperture in it, (as at *a*, Fig. ii.) which is supposed to be a mouth; in the centre there is an opening larger than the rest, within which, when the inclosed animal was alive, something like fibres were perceived to move; whether this creature extends those fibres to lay hold of the food which the waves throw in its way, must be referred to future enquiryⁿ. Somewhat different from this, though of the same tribe, was an alcyonium which I found on a ledge called Careg-killas, in Mount's Bay, where, as I was tumbling over the moveable rocks, I found one coated with a transparent, callous substance, spread on some rocks about six inches, in one near two feet square at a medium: the coating was about the sixth of an inch thick; the ground was dark green; the flowers consisted of ten obtuse petals, which were of a vivid yellow green; each petal was in two places pierced of the *field* (as the heralds term it); that is, had two specks in each (in this differing from the foregoing) which transmitted the colour of the *field*; the flowers and ground together made so pretty a piece of tapestry, that one might be surprised to find such colouring and workmanship hid, as it were industriously, under a rock; but the works of nature are every where well finished, and cannot be otherwise than exact and beautiful in their degree. Part of this coating, with its roses in their natural size, may be seen Plate xxv. Fig. iii. magnified, Fig. iv. Searching a little further I found a like congelation on another rock; the ground of this was of a warm brown colour (such as the painters call Cologne earth); the petals of the flowers were sharp pointed, not always of the same number, but from six to twelve; the flowers were radiated, irregular in shape, as may be seen Pl. xxv. F. v. magnified, F. vi. not pierced as in the foregoing, quite yellow, and on the brown ground looking like so many aste-

ⁿ It was shewn me the day after it was dredged, and from a drawing then made, published in the Philosophical Transactions, vol. XXXIX.

part II. 1756, page 451, and is supposed to be a non-descript.



Scale of inches for the Sea nettle April 1737.

risks of gold ; but their beautiful colour immediately faded, though kept in salt water, so that they are to be seen in perfection only and drawn (as these were) on the spot, and when the alcyonium is fixed ; when dried, they shrivel up like a piece of singed leather, and their substance ferments strongly with *aqua fortis*. There is no doubt but these alcyonums consist of an arrangement of the jelly-like bodies of a certain animal determined to form in such thin coatings upon the rocks. The ingenious Mr. Ellis^w has shewn beyond contradiction that the corallines are pervaded in all their stalks and branches by polypes. Into these bodies (so adapted by their jointed structure to float to and fro in the water, and to place them in the reach of their proper prey) they either insinuate themselves, excavating cells for their eggs, and stiffening tubes and passages for themselves and their supple young ones, or according to another hypothesis lately espoused by gentlemen of great experience in this branch of science^x, they form this coralline armature for themselves from the very foundation, being taught their lesson by the same Master who instructs the snail, the oyster, and the belemnite to build according to the exigencies of their specifical shape of body*. However that be, through the extremities of the coralline boughs they thrust forth their *tentacula* or arms to seize their prey ; they are so small that they are seldom to be seen but in microscopes, their prey is proportionably smaller and weaker, yet probably animals, and those have other subordinate species of animal-food beyond the reach of glasses (for what else but animal-food can consist of parts fine enough for their vital passages?) ; all these are furnished with life and motion, that whilst they range in search of their own food, they may disperse and gradually communicate animal nourishment to their superiors in size and usefulness to mankind.

Among a parcel of sea-plants brought me March 24, 1752, I ^{Worms:} found a sea-slug, smooth and slimy as the land-slug or dew-snail, pointing forth its eyes on its *antennæ* ; it crept and clasped, contracted and extended itself, (as the snail) by its belly, but had this peculiarity, that it emitted at times a most beautiful purple colour ; when it was almost dead, on dropping a few grains of salt on its back, it sent forth the purple dye very plentifully. It seems to me of the Holothurian kind ; of which Rondeletius treats, part II. p. 125.

Fig. XIII. Plate xxvi. is the long-worm found upon Careg-killas, in Mount's Bay, which, though it might properly enough come in among the anguilli-form fishes, which are to succeed in their order, yet I chuse to place here among the less perfect kind of sea-animals : it is brown, and slender as a wheaten reed ; it measured five

^w F. R. S. London, Hist. of Corallines, printed in London 1755.

^x Mr. Ellis, before-mentioned, and others.
^{*} See page 242, before.

feet in length (and perhaps not at its full stretch), but so tender, slimy, and soluble, that out of the water it will not bear being moved without breaking; it had the contractile power to such a degree, that it would shrink itself to half its length, and then extend itself again as before. But to run through all the sorts of worms, the *Tethys*, the *Lernæa scolopendra*, *Pulmones*, *Fungi*, and others, would be remote from my design, some few enquiries to excite curiosity may here be sufficient, and a great deal, after entering into the *minutiae*, would be still incompleat. *O mare, O Littus! verum secretumque Mæstrov!* *Quād multa irvenitis, quād multa dictatis?*^y

Sea-nettles,
or *Urticæ
marinæ*.

Of sea-nettles (so called from the pungency with which they affect the hand, not very unlike to that of the land-nettle) we have the *Urtica rubra Saxo innata Aldrovandi* (*Tab. de Zoophytis*, N°. vii.) in almost every pool on the sea-shores, and also the *Urtica rubra Rondeletii*, (page 530, lib. xvii. chap. xviii.) In some caves in the parish of Piran-Uthno, washed often by the tide, I found several; in colour they varied from the finest scarlet four degrees down to the deepest purple, finely powdered with yellow specks, which, as the animal expired, became more pale and lanquid. These animals are as energetick with the claspers by which they fix themselves to the rocks, as by their arms which are continually waving to and fro in search of food.

Of sea-nettles, unfixed and *nayant*, I have observed the following variety:

The *Urtica marina*, Plate xxv. Fig. vii. is called *Medusa*. I have not found it fully described, and therefore I shall be more particular in my account of it: Its figure is round, its back convex, marked in the centre with a seeded circle, *a*, of an auborn colour; at three quarters of an inch distance from the circle begin the sixteen rays, *b b*, which point inwards to the centre, and divide into two branches or legs as they tend to the circumference, each leg terminating in a little egg-like knob, *c c*, half an inch long, one fourth of an inch distant from one another: after this insect had rested about half an hour in the dish I placed it for view, a hamous, crooked, little fang, *d d*, appeared and was protruded betwixt each knob, as in the figure: the substance was a kind of jelly flesh, in the middle hard and cartilaginous, the circle and rays were auborn, the body somewhat clouded for an inch and a half round, and under the central circle, but of the most perfect crystal transparency every where else: its body was one inch and a quarter thick; from the convexity, it descended quick near the *limb*; so that the egg-like knobs, *c c*, spread horizontally. In the centre of the under part

^y Pliny Jun^r. to Fundanus.

of the same fish, Fig. viii. was the mouth, *e e*, in the figure of a cross, which closed or opened as a strong muscular *labium* at each angle of the cross did operate; at each extremity of the *labia* was fixed a leg or a *tentaculum*, *f f*, about a quarter of an inch thick, flat in substance, auburn in colour, between three and four inches long (perhaps maimed); at the basis, where these joined the body, they were larded or fanged by part of the same crystal jelly as that of the body, flat as a fin; within the mouth was a cavity of about four inches diameter, where its sustenance with its bowels was lodged^{*}.

Fig. ix. ibid. is the back of another variety of the medusa kind. It is convex in the middle, but slopes away quicker than the former at the edge, which is thin; in the centre it has a pale purple cross, *g*, of four pointed rays, between which there are four bell-like foliages of the strongest purple; from the extremities of these foliages proceed rays of a faint purple diverging to the circumference. In the belly of the same fish, Fig. x. there is a cross-like opening made by the convention of four triangular muscles, *i*; and at each commissure of these muscles there is a fang or leg of the same transparent substance as the body; with these legs, I apprehend they raise themselves from, or stick close to, the place where they chuse to rest, reach, and convey the food to the mouth, use them as fins to swim, or as legs to walk through the paths of the sea.

Fig. xi. ibid. is another variety of the medusa's, and differs from Fig. vii. before described in the following particulars: It has no circular *nucleus* in the middle, but a seeded spot only; its rays are solid, and not divided into lines. I could perceive no hamous fangs at the *limb*; its *tentacula* or legs, *m m*, being extended, spread fourteen inches, as in Fig. xii. which is the under part of this medusa.

Fig. xiii. is another variety: It has no colour but that of the purest crystal jelly, oval in figure, on the back it is convex, and on the under part, Fig. xiv. has four separate cavities, but no fang, tentacle, or other projection.

Fig. xv. is the belly view of another *Urtica* of the same kind as the last (as I imagine), but adult and perfect, found on the Mount's Bay shore, August 2, 1757, which I have never seen described: Its brim much thinner than the other parts to further its motions, scalloped, edged with fang-like appendixes at the several protuberances, *a b*, and two others, (the rest probably broke off). The holes, *c c*, are the four mouths or inlets into the *abdomen*, supplied with muscular excrescencies which serve to close them occasionally. It had eight legs, *d d*, all dependant from a stem or stalk, *e*: this stem is

* Qu. an *Urtica astrophyta* Linnæi, Syst. Nat. Spec. 4 Gen. Zoophy. page 237.

dressed round with fourteen fangs, *ff*; the back is round and convex, like that of the rest; the whole transparent, colourless, and cartilaginous; and to distinguish it from the rest, may be called *Urtica marina ex truncō octopodalī limbo imbricatim undante*. These five are designed by the scale, A A.

But the most beautiful of this kind which I have met with, and as far as I can learn has not been yet described, is Fig. xvi. ib. p. 254, which, being large, is here described by the scale, B B: It is all of the most pure crystal jelly; some have a greenish cast; the margin is formed by little semicircular fangs about half an inch diameter, and as much distant from each other; transparent as the rest, but that at their very brim they are tipped with a very beautiful blue. Four scutcheon-like figures, *ee*, aptly joining their base points, form a slender *fulcus* in the form of a cross at the center; four figures in the form of a heart, fill the vacancies between the sides of the scutcheons; from the circumference of this compounded *nucleus* proceed sixteen notched fangs, *dd*, contiguous to each other at their base; on the outside of which at every *fulcus* betwixt the scutcheons and the heart-like appendixes are inserted the legs or tentacles in number viii; they are here turned back and displayed *bb*; those parts of the legs next the body (which is here marked *cc*) are flat; but what is next the eye is divided into three blades about three quarters of an inch thick, jagged, carved, or furrowed at the edges, but the lower part, *ff*, flattened like the blade of an oar, with three angles for the better cutting the water, as may best be apprehended from the icon: between these legs are eight crescent-like mouths, *aa*, which have a bunch of jelly at their aperture to close and open them; all these mouths are inlets to one common opening which extends within the central *nucleus*, making a circular cavity, the dimensions of which may best be seen at *eee*, in Fig. xvii. within this cavity are the intestines, consisting of a continued series of gut, yellow without, fastened to the body by a common membrane of about three inches deep, on which the guts are dependent: Fig. xvii. represents the back of this creature with the legs *pendant*, as Fig. xvi. represents the various imagery of the under part. Till I am better informed of a name, I should call this *Urtica marina octopodalis octo faucibus et variis appendicibus ventralibus distincta*. It was found on the sandy beach betwixt Penzance and Marazion 1756.

These creatures swim obliquely, contracting alternately, and expanding their brim and promoting their rest and motion by the legs which they are supplied with: their motion however cannot be swift, which makes them an easy and probably a nourishing and delicious prey to larger fish; but they are sometimes eaten by man.

Rondeletius,

Rondeletius, page 532 and 533, has given us (but very different from any here described) two of the *Urticæ solutæ*, whence they are copied into Aldrovandus's Table xviii. de Zoophytis, Natural History, page 187. Some call them Blobbers; the Cornish name is *Morgoulis*.

Of the *Stella marina*, or star-fish, Mr. Lhuyd found one near Stellæ mari-Penzance, which he calls *Decempeda Cornubiensis*. (*Linckii Tabula næ, or star-xxxvii. N°. LXVI*). This is very rare; for in Cornwall this animal fish.

has generally but five rays. Of this tribe we have varieties, as the Echinaaster, or *Stella coriacea pentadactyla echinata Luidii*; *Linckii*, Tab. iv. N°. vii. In this sort the bristles of the back are high and spinous; part of one (if I do not mistake) may be seen Plate xxv. Fig. xviii. The following six are of different colours, the central bosses or *fibulæ* variously embroidered, and the rays of different workmanship.

Fig. xix. ibid. is entire; the *Asteriscus, seu stella marina pentadactyla exigua lutea vulgaris*, from the sea-shore of Ludgvan; the rays, when the fish was first taken up, extended five inches and a half, were stiff and round, but by the next morning flatter, lank, and enervated, extending six inches and a half in diameter; in the under part a pentagonal *nucleus* occupied the centre, from each angle of which branched off a ridge of *papillæ pyramidales*, with sharp horny points, running nearly in the middle of each ray; the ground-colour was cinereous, tending to a purple; the *mammillæ* of a brick colour, the point of the rays a deep purple; but when dead, of a brown yellow; on the belly-part each side of the rays had strong hard bristles shooting transversely, between which there was a great number of transparent, soft, fleshy tubes, or *antennæ* with small knobs at the extremity, which began to move and exert themselves, as soon as the fish was laid on its back; with its rays it crawls like a crab: the uppermost bristles of the rays seem designed for defence, and perhaps to assist its motion; the *antennæ* of the underpart (which it shoots forth and contracts like the horns of a snail) serve to move it to and fro (perhaps to see and reach its prey), and fix it also when and where it chuses to rest.

In Fig. xx. the light parts are of a bright-yellow ocre, the dark part brown-red, of different degrees, intermixed and figured as in the plate; the rays three inches long.

In Fig. xxi. the *fibula* is of an olive green of different degrees; the stem of each ray is distinguished by a lozenge, and studded; that is, divided into square compartments, alternately red and Naples-yellow, twenty red spots in each ray; the rays two inches and a half long.

In Fig. xxii. the *fibula* is of a black ground, striped with leaves

leaves of a bell-like figure, with milk-white pointed javelins at the insertion of the rays which are of a brown, speckled green; the stem marked with transverse lines; rays three inches long. One of this sort (that is, with leaves of the *fibula* shaped in like manner) has a yellow *fibula*; but the stem of the *radius* is diversified by square compartments, as in Fig. xxii; rays two inches and a half long: A third has no javelins at the insertion, but the bell-like leaves with a whitish *nucleus* in the centre, and the stem of the ray cut into squares of the richest scarlet intermixed with green; rays three inches long. In Fig. xxiii. the *fibula* is black, pentagonal, intersected by five white slips (of the figure of a Lens) running from the stem of the ray to the central *nucleus*; the rays of an olive green, studded with dies of a darker colour. In Fig. xxiv. the *fibula* consists of five petals only, the outer edge of which is a brown Cologn-earth, lightning into a yellow in the middle; the rays are distinguished by two rows of dies, one on each side of the stem, the dies opposite, and of a dark green; another with like rays has the like *fibula*, but of a sky-blue colour; rarely met with.

Fig. xxv. is the back of a *Stella marina saxis infixa*. Fig. xxvi. the belly-part of the same with which it sticks to the rocks; it was of a flesh-colour; they are all of the same size I found them on Careg-killas near Penzance, October 8, 1756. Some other little differences occurred; but these are sufficient to intimate what diversity of colourings and workmanship may be met with in this tribe.

Sepia, or cuttle-fish. On the shores of Mount's Bay we frequently find the cuttle-bone of the sepia or cuttle-fish, or ink-fish, by which it appears that the sepia of Rondeletius, page 498, though reckoned rare on the English coast, is not so uncommon on the shores of Cornwall: Its bone is used by the silversmiths in polishing, and sometimes admitted into the shops among tooth-powders, &c. Galen and others think these soft fish very nourishing, easy of digestion, and great attenuators of the blood^a.

Loligo, or ink-fish.

Fig. xxvii. Plate xxv. is the *Loligo*^b found in Mount's Bay 1757; and being a fair entire specimen of this uncommon animal, I add the following description: The body is eleven inches long, compressed, one inch and a half thick, spreading on each side into a thin, triangular, fleshy substance, *aa*, which serve as fins in water, and as wings in air; the tail much more obtuse than that of Rondeletius page 508; the head, *c*, is globular, one inch and a half high; it had ten tentacles, *dd*, of various lengths; the two longest, *ee*, are pedunculated, not extended to their full length, their stems round, and near the extremities their upper side spread

^a Rondel. chap. II. lib. xvii.

^b *Loligo minor* Rondel. page 508. *Salviani major* Aldrov.

with

with tubular cups of the same fleshy substance as the stem ; they end in certain nipples or tubercles : the other *tentacula* are more flat and wide ; they have one edge also full of these nipples, with a few cups in the middle of them ; of these cups I apprehend the fish expands, and contracts the brim for the reception or emission of the air, and fixing itself by suction to rocks or plants, as well as for laying fast hold of its prey : the *tentacula* are both arms and feelers, and by the membranous and tender structure of their tubes, doubtless of most acute sense ; by the recurve figure in which they stiffen as the animal dies, they appear also to quicken the motion of swimming by their alternate extension and contraction. This fish contains inwardly a certain juice so black in some of the kind, that it may be used for ink^c. Pliny thinks it the blood of the animal; but by later discoveries it appears to be an excrementitious secretion from the aliment, which from its own repository the animal sheds when under the apprehension of any imminent danger, and thereby discolouring the water, frequently conceals himself from his enemy. The Athenians held this fish very cheap, but now the smaller sort especially is much coveted, and by some placed among the greatest delicacies of the table, when seasoned skilfully with oil or butter, pepper and wine ; but Rondeletius thinks them hard of digestion, lib. xvii. chap. v. This specimen had one bone in the middle like the blade of a dagger (therefore called its *gladiolus*) ; its use is to stiffen the soft and lax flesh of the body ; it had plenty of ink, and was found on the sands of Mount's Bay 1756.

C H A P. XXIII.

Of Fish.

FR OM the least and seemingly most imperfect sea-animals, but equally necessary in their degree, we are gradually arrived to the most perfect inhabitants of the ocean.

And if I were here to set forth an orderly arrangement of fishes in general, I should trace them through the several classes into which nature has sorted them, by lungs and gills, by bones and cartilages, by the number, shape and place of fins and teeth, by the scaly armour of some, and by the mucilaginous smooth coating of others ; but as my plan is local and more confined, I find myself only engaged to pursue the finny race through the waters of this

^c Rondeletius, page 501.

county, as they were before divided into rivers, lakes, and sea, and with as much order as these departments will admit.

S E C T . I .
River and
lake-fish.

In our rivers, besides eels and minies, and other less considerable, we have the shote⁴, a small kind of trout, but in ponds growing to about twelve or fourteen inches long, and by some reckoned⁵ in a manner peculiar to this and its neighbouring county: the flesh is white and less firm than that of the trout: it is common in all brooks which are not infected with the mudi-c-waters of our mines, waters fatal to all fish sooner or later, but much sooner to those which delight in clear running water as the shote does. This fish may be seen in Willughby's Tab. N. 4, Fig. 2, but indeed not to advantage.

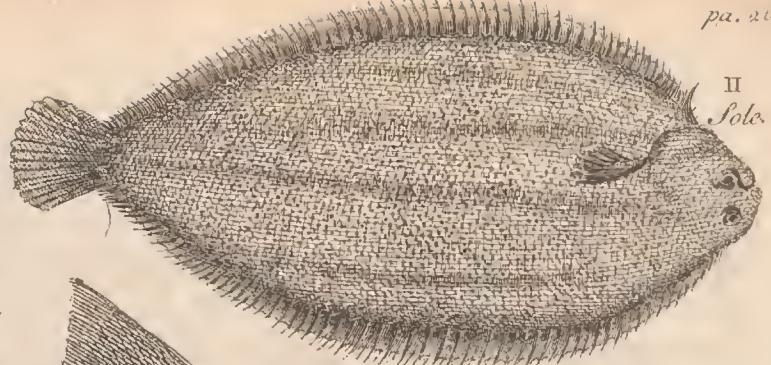
In our Cornish rivers we have not the jack, perch, carp, crayfish, or others with which Providence hath stocked the rivers in the more inland parts of Britain, as it were to make amends for their being so distant from the much greater variety of sea-fish; but of the trout kind we have several sorts, and in their season in great plenty. In the last age there was a remarkably good one in the river Conar, which divides the parish of Camborn from Gwinear and Gwythien; but the many mines which have been of late years wrought in the neighbourhood, have destroyed this fish. In the rivers Alan and Laine, near Pendavy, they take a grey trout in the summer time, the flesh of which is red and delicate. In the river Fawy, near Loftwythiel, is taken the black trout in the month of May, and till the latter end of June, sometimes three feet long; in July the salmon-pele comes up the same river, but is more commonly caught at the mouths of rivers, and in the sea-waters, than in the rivers themselves; and about the latter end of August succeeds a trout, called, from the time of its appearing, the Bartholomew Trout, not so large as the black trout, being about eighteen inches, rarely more; it is deeper in the belly, cuts red, and is esteemed by some before the black trout, and both before the salmon. The salmon is properly a sea-fish, and comes only occasionally into the river, as to a place of more security from storm and enemy, to cast its spawn, on which it is so intent, that it will go up into large rivers four or five hundred miles⁶, then returns to the sea as its proper element, but must be placed here, because the rivers generally afford us this fish. It is caught in the river Fawy at two Wears, one belonging to Lanhidrock, the other to Glyn, from the latter end of the spring to the end of autumn. The salmon is taken also in the season in great plenty at Lord Edgcumbe's Wear

⁴ *Trutta fluviatilis minor.*

⁵ Carew, page 26.

⁶ Ray's Creation, page 130.

So Trout.

The Weever,
Draco marinus or
Sea dragon.

IV

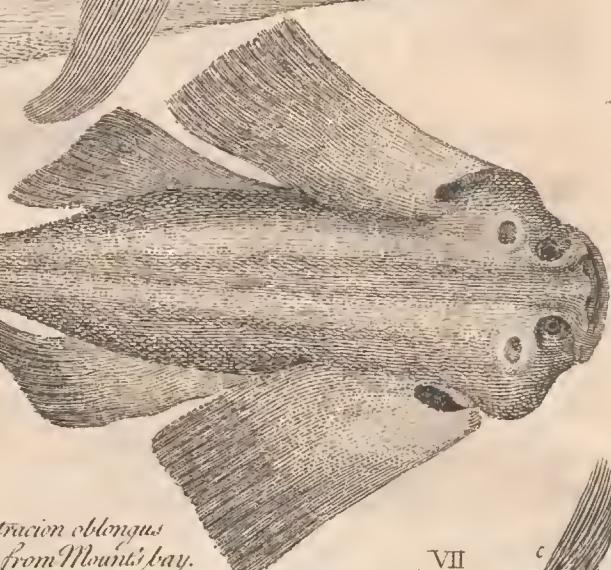
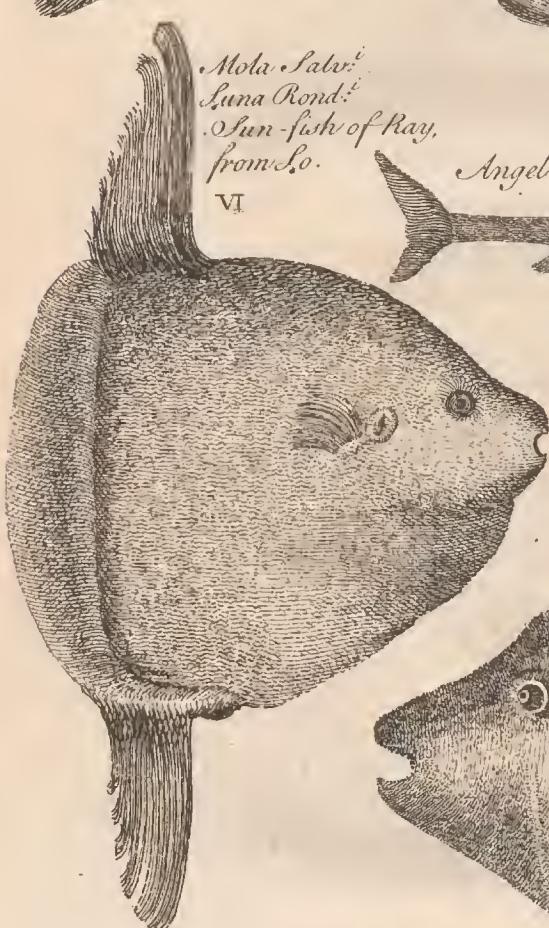


The Porbeagle a small Shark.

*Mola Salv.**Suna Rond.*Sun-fish or Ray,
from So.

VI

Angel fish.

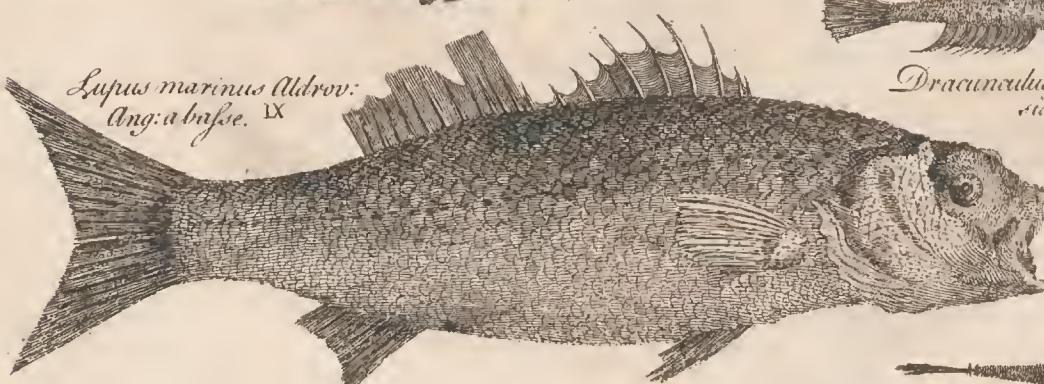
*Mola Salv.* *Ostracion oblongus*
Artedi. Sun-fish from Mouni's bay.

VII

VIII



Black fish.

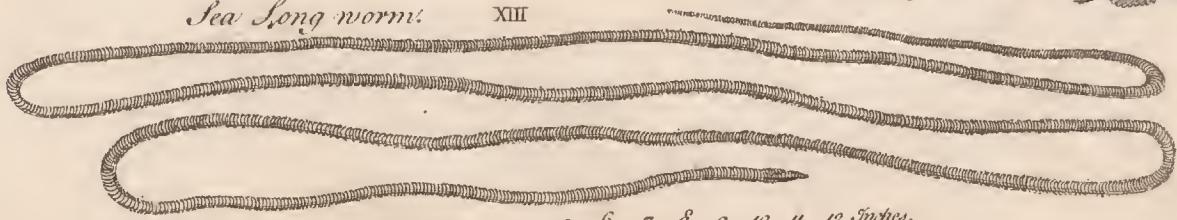
*Dracunculus marinus* Rond.
side view.*Lepidus marinus* Aldrov:
Ang: absoe. IX

Sea Song worm.

XIII

Dracunculus y back view.

XI



1 2 3 4 5 6 7 8 9 10 11 12 Inches.

at Cûthel, on the Tamar, and near Bodman, on the river Alan, at a wear of Mr. Flammock of Boscarn.

The Lakes in Cornwall are but three; Dofmery Pool yields only eels; the Swan Pool, near Falmouth, eels very large and good, with a mixture of small sea-fish; but the Lo Pool, in Kerrier hundred, nourishes a trout, which deserves more particular notice. Of this the icon may be seen with the several parts by measurement, Plate xxvi. Fig. 1. The eye is large, the back of a deep black purple, on which the scales of a silver hue; the belly, from the straight line which passes from the gills to the middle of the tail, of a bright pearl colour. The spots are hexagonal annulets of a scarlet colour in general, but purplish on the back, pierced of the *field* they stand on; the anterior back-fin has thirteen spines, wavy at the top, with small tender points; the posterior back-fin is entirely carneous, without any spines; the gill-fins foliaceous in shape, with twelve spines; the belly-fin small, with nine spines; the anus-fin nine spines; the tail-fin remarkably large, and very little forked; the flesh very red in the season, and much esteemed. The salmon-pele above-mentioned is very different from this trout, being more circular in the back; the lower mandible rather longer than the upper; the belly more silvered; the body deeper, and less round; the gill-fin and anus-fin less in proportion; the belly-fin larger, and the tail more forked. This is perhaps a larger sort of the *salmulus Baltneri*. Will. Tab. N. 4, Fig. 3.

The sea is the great store-house of Cornwall, which offers SECT. II. not its treasures by piece-meals, nor all at once, but in succession; all in plenty in their several seasons, and annually, as it were to give time to dispose of what is sent; and yet in such variety, as if nature was solicitous to prevent any excess or superfluity of the same kind.

Of the *Balaena* or whale kind (that I may follow the usual order of Ichthyologists) we have the blower or fin-fish (the *physeter* of authors) so called by the antients from the quantity of water which, from its mouth, it blows aloft into the air through a pipe or hole in the head adapted to this particular use. *Balaena edentula corpore strictiore dorso pinnato*. Ray, Syn. page 9.

The grampus, or *Porcus marinus major* of Ray, page 15; the *Delphinus rostro sursum repando dentibus latis serratis* of Artedi*, page 106. It is usually about eighteen feet long, sometimes large enough to weigh a thousand pounds weight; so voracious, that it will prey upon the porpesse itself, though of its own likeness. Ray, ibid.

* A late learned Swede, whose accurate account of fish was published after his death by Dr. Linnæus.
The

The porpesse, *Porcus marinus seu Phocæna vel Tursio; Delphinus corpore fere coniformi, dorso lato, rostro subacuto*, Artedi, page 104. I have given an icon of this fish Plate xxvii. Fig. ii. from a drawing of that accurate Ichthyologist the late Reverend Mr. Jago of Loo. It must be acknowledged by the greatest admirers of Mr. Ray and Mr. Willughby, that the fish in their work are very imperfectly engraved. What is remarkable in this icon here inserted is, that the dorsal-fin points forward to the head, and slopes away backward; a singularity which I have never yet seen taken notice of in authors, and which so accurate a designer of fish as I have reason to think Mr. Jago (from his drawings, as well as Mr. Ray's character of him in his Synopsis Meth. Pisc. page 162), could not, I should think, mistake; yet is the direction contrary to nature, and I have no other authority as yet for placing it thus, but that of Mr. Jago^s. It is called *Porcus-piscis*, or porpesse, from the copious quantity of lard with which all its body is sheathed, and underneath this lard the flesh is red like that of a hog: it also resembles the hog both in the strength of its snout, and also in the manner of getting its food by rooting. Ray's Creation, page 140.

The dolphin, the *Delphinus* of the ancients and moderns (Ray, page 12). *Delphinus corpore oblongo, subtereti, rostro longo acuto* of Artedi, page 105. It is in many particulars like the porpesse, but longer, more slender in body, more white in the belly-part, and spotted; not so broad on the back; its snout more projected, and sharper, somewhat like the beak of a goose; add to this that its dorsal fin (quite contrary to that of the porpesse) slopes forward towards the head, with its apex pointing backward, like the fins of other fish. I have given an icon of this, Plate xxvii. Fig. i. from a drawing found among the papers of the late Mr. Jago above-mentioned^h. These four cetaceous fish prey upon the pilchard and the mackerel, and in fair weather, when such large fish can venture into shallow water, the porpesse pursues them near the shore.

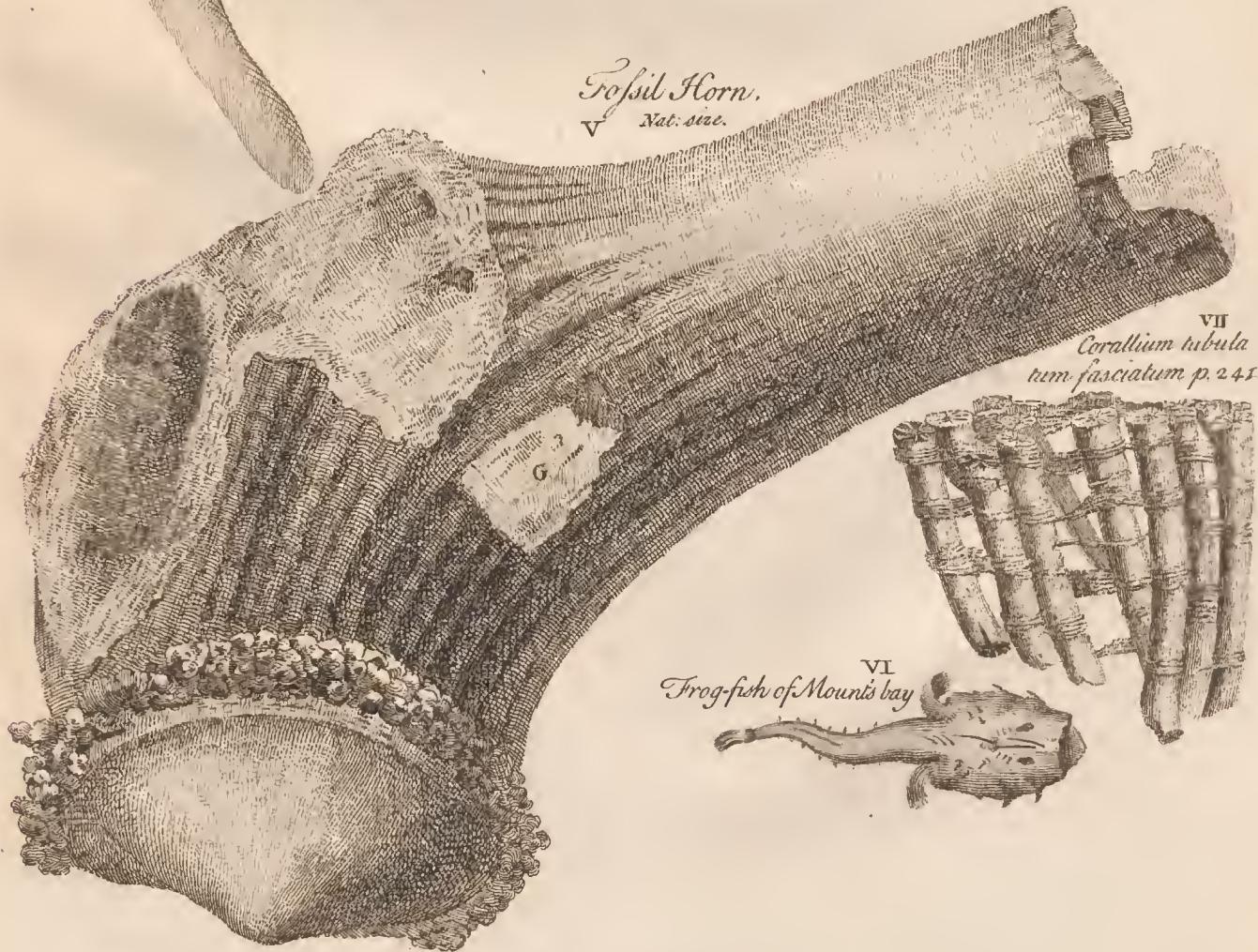
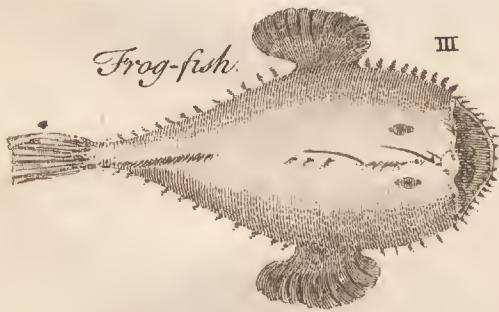
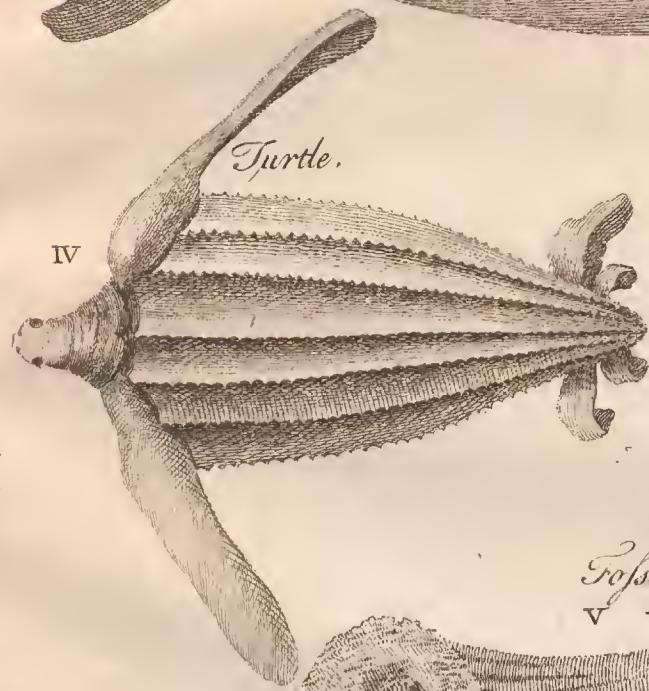
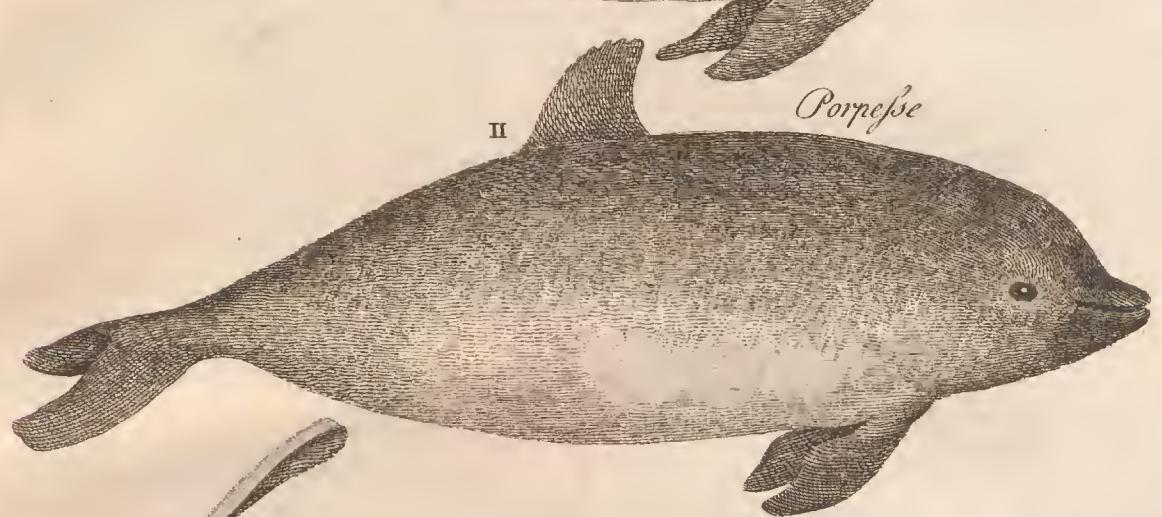
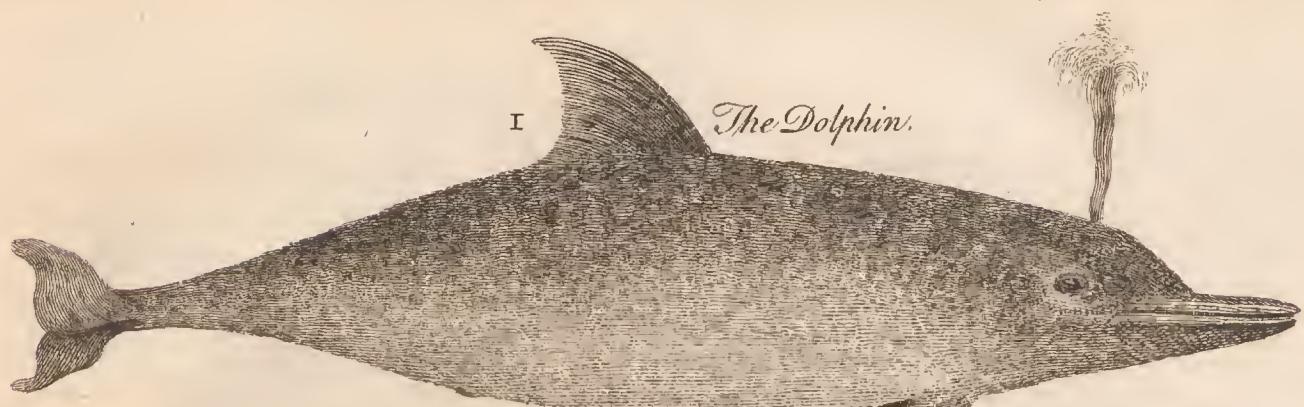
SECT. III. Of long cartilaginous fish, among others we have the blue-shark described by Mr. Ray, Willughby Ichthyol. lib. 3, chap. 3. This fish haunts the Cornish coasts all pilchard-season, and though greatly inferior in bulk to the white sharkⁱ, is so great an enemy to the fishing-nets, that the fishermen have large hooks made by the

^s This gentleman intended a history of our Cornish fish, as Mr. Ray says, ibid. but it is feared that his notes and observations are lost, which the curious will always regret; the few drawings which were found were kindly communicated to me by the Reverend Mr. Dyer, Vicar of St. Clare in Cornwall, and Chaplain of East Loo;

and what are rare, and not already published in the end of Mr. Ray's Synopsis piscium, are inserted in this work with proper acknowledgements.

^h From its high dorsal fin, this fish is sometimes in Cornwall, but very erroneously, called the Thorn-back.

ⁱ *Canis carcharias seu Lamia* Auth.



country smiths on purpose to catch them; they breath through holes or pipes on each side betwixt the mouth and the pectoral fins, not through gills.

Of the shark kind (besides others^k which have been reckoned by Mr. Ray, who came to Penzance on purpose to collect and examine the sorts of our Cornish sea-fish) we have the sea-fox, *Vulpecula*, or *Simia marina* of authors; this shark we call the Thresher, from the motion of its long fox-like tail with which it strikes or threshes its larger and less agile enemy the grampus, whenever it reaches to the surface of the water to breathe. This engagement lasts several hours as I have been informed by an eye-witness^l.

We have also another shark, which we call the Porbeagle, of which I give an icon Plate xxvi. Fig. iv. from Mr. Jago, it being very different in shape from any in Willughby, or any other Ichthyologist I have examined.

Of the flat and broad, cartilaginous and spinous, besides the SECT. IV.
more common skates and flaires, which we call rays, we have one Flat fish,
in Cornwall called the Cardinal Trilob^m, or three-tailed ray; se-
condly, a Britton or Burton skate without any spines, excepting
only a few on its tail; the *Raia oxyrinchos lœvis* of Jago; Ray,
page 165.

The monk or angel-fish, (otherwise termed the Mermaid-fish, as Arredi says) the *Squatina Rondeletii*, page 367; Ray, page 26; of which uncommon fish, of a middle nature, partaking both of the dog-fish and ray, I add the icon, Plate xxvi. Fig. v. Two of these fishes, one four feet seven inches long, the other small, were taken in a tramel-net at Penzance, July 11, 1757. That here described is of a middle size, the belly white, the back of the colour of a sole, without streaks of white, as in a drawing I have seen of Mr. Jago, and without the *Linea aspera* in the middle of the back, as in Rondeletius, lib. xii. chap. xxii. and Mr. Ray, page 27.

Among the papers of Mr. Jago, I met with an accurate drawing of the *Rana piscatrix* of Rondeletius, Willughby, and Ray, &c. the *Lophius ore cirroso* of Aredi, (G. Pisc. 41) which, because it is little known, and not faithfully represented in the books I have seen, I have given the icon of, Plate xxvii. Fig. iii. adjusted to the scale of the dolphin, &c. with the exact number of the appendixes at the edges, and stiffenings of the pectoral fins according to Jago. But very different is the *Rana piscatrix* (Anglicè frog-fish, or sea-

^k The tope, picked-dog, smooth or unprickly hound, bounce, alias greater cat-fish, in the Cornish, morgi, that is, sea-dog, &c. Ray, Syn. page 20.

^l The Reverend Mr. Dyer, Vicar of St. Clare.

^m In the Cornish language signifying three tails.

devil) represented Plate xxvii. Figure vi. found on the shore of Mount's Bay, August 9, 1757. It had no fin-like appendixes round the head as that of Rondel. lib. xii. page 363, and that of Mr. Jago, but only on the tail part, interspersed at the sides from the beginning of the dorsal-fin to within two inches of the insertion of the tail; they were three quarters of an inch long; it had more capillaments and aculei than Mr. Jago's, and a longer rounder body than that of Rondeletius; it had spines at the end of the pectoral fins an inch and three quarters long; spines also at the extremity of the tail three quarters of an inch long: the head in general more bony, rough, and aculeated than in either of those authors.

The Turbot, alias Brett, *Rhombus maximus asper non squamosus*, (Ray, page 313) is an excellent fish, comes in the summer and autumn months, and in such plenty sometimes in Mount's Bay, that two boys have taken thirty of them in an evening with hook and line.

We have also the *Rhombus non aculeatus, squamosus*, called at London the Pearl, in Cornwall the Luga-leaf. Ray, ibid.

Besides others found here by Mr. Ray, as the plaife, dab, flounder, Mr. Jago (Ray, page 163) mentions the kitt, the *Rhombus lœvis Cornubiensis maculis nigris creberrimis respersus pulchrioribus quibusdam interlucentibus*; the flesh nearly as good as that of the turbot.

We have also the whiff, the *Passer Cornubiensis asper* of Jago, ibid. of which the flesh is good for nothing.

We have also the holibut, the *Hippoglossus* of authors: this largest of the flat kind is rare: there was one taken in Mount's Bay in February 1756; the colour dark green, scales small, body longer, larger, less square than that of the turbot.

The sole is frequently catched on our sandy shores, but rather larger on the sands of Scilly than in Cornwall. Finding the prints in general of this fish defective or redundant in some particularsⁿ. I have given an icon of it Plate xxvi. Fig. ii. with its spines numbered, from a fair specimen of Mount's Bay.

We have also the *Solea lœvis, vel arnoglossus*, called the Lantern by the Cornish (says Mr. Ray, page 34) from its transparency.

SECT. V. Of sea-fish round, long, and of the eel-form, in Cornwall the Fish, round, conger or conger-eel may be reckoned first: We have also the free-long, &c.

ⁿ In Rondeletius the mouth is neither rightly shaped nor placed; the branchial fin is too large, and not spotted black at the end; the side line is too large, and continued to the upper eye; whereas it is indeed a straight slender line from the middle of the tail to the under or left eye, and ends at

the cheek-bone, and the mouth winds round close under the right or upper eye; and in him the tail-fin is perpendicular; whereas it is really circular, as in this drawing. This fish had sixty-eight spines on the mouth-side, and eighty-eight on the opposite.

eel,

eel, the *Anguilla libera* of Jago (Ray, page 166) which has a milder taste, and fewer little bones than the conger.

Our launces, or sand-eels, are extremely good; they lye about six inches deep in the sands when the tide is out, but this seems only their place of retirement to wait the next tide; when that tide returns and covers them, they expatiate again in the waters: they are sometimes taken among the pilchards, as Mr. Jago informs us, Ray, page 165, ib. giving the icon of one fifteen inches and a half long, with one belly-fin, which Mr. Ray's wanted^o. This fish is also found in the stomachs of porresses, but whether from their rooting them up out of the sand, as Mr. Ray (Creat. page 140) observes, or nayant, can scarce be determined.

We have a kind of sea-adder which I find not at present well described: It seems a species of the acus, or needle-fish, but very different from the sea-adder (as the Cornish called it) brought to Mr. Ray^p; his was like a worm (*Ophidion lumbriciforme*), no more than five inches and a half long, of the bigness of a goose-quill, ending in a sharp finless point: this was sixteen inches and one eighth long, had a back and tail-fin, the proportions as in this figure, Plate xxvi. Fig. xii. the scales shaped like those of a land-adder: its paunch being opened, some hundreds of young fry (like little eels) put into water, soon moved to and fro^q; it had a semicircular *fulcus* on the back.

Plate xxvi. Fig. vi. is the fun-fish taken at Penzance in May 1743^r. It was three inches thick at the back, at the belly only three quarters of an inch; the tail cartilaginous, pellucid; the colour dapple, spotted darker on the back; the belly silver, pearl-coloured, with streaks or fillets half an inch wide, consisting of two lists of dark, between which the middle list was pearl spotted with black: these streaks begin under the eye, and continue at equal distances to the pectoral-fin; smooth without scales. This fish was but small, as may be observed by the scale annexed; but they are sometimes extremely larger. In the year 1734^s, there was one taken at Plymouth of above five hundred pounds weight; and in Ireland they are sometimes taken twenty-five feet long, and proportionably thick^t. There is a shorter sort of this fish (Willughby, Tab. i. page 29) which is described by Ray, (Synops. page 51) who met with it at Penzance: I have added the icon of it from Jago, adapted to the general scale, Plate xxvi. Fig. vi. It is the *Orthragoriscos sive Luna Rondeletii*, page 424, the *Mola Salviani & Raii*, page 51, and the *Ostracion quartius* of Artedi, page 83. This fish

^o See ibid. page 38.

^p Ibid. page 47.

^q Qu. an Acus 2^{da} species Rondel. Willughby, Tab. i. 25, Fig. vi.

^r This is the *Ostracion oblongus*, glaber, capite

longo, corpore figuris variis ornato of Artedi, N°. 23, page 86.

^s Philos. Trans. 1742.

^t Hist. of Waterford, page 271.

is called by Ray and others the sun-fish, as being round, and emitting a kind of splendour in a dark room ; by others (with Rondeletius) the moon-fish, because not only round and shining by night, but having the shape of the crescent (see Plate xxvi. Fig. vii. page 263, *a*) betwixt its little pectoral fin and eye ; but what is more remarkable in this creature is, that so large a fish should have such little fins, and those mostly at its hinder parts : this fish is one conspicuous instance how artfully nature adapts the instruments of motion to the form of the body which is to be moved ; it is so thin, long, and flexible, that a large fin in the former part would hinder its swiftness ; being itself but one thicker fin, it wafts itself forward in a great measure by the meer bending of its back from side to side, whilst its wedge-like form, and sharp-pointed head, easily cut their way ; but the chief momentum is from behind, where the tail-fin, *bb*, is fixed as a rudder and an oar too, reaching from top to bottom, to keep the whole body on its edge the more steadily, as well as further and guide its progres : at each end of this singular appendix is a fin, the upper one, *c*, raisng itself above the body, and the under one, *d*, tending below it, both by their spread encreasng the force in these parts, co-operating with the wavy flexures of the body, and accelerating its progres in the same manner as an oar working at the stern of a boat, drives forward and directs the whole machine.

SECT. VI. Of spinous or bony-fish, the rays of their back soft and flexible, Fish, spino-
nous, bony, (called *Afelli* from their asinine colour) we have the cod or keel-
&c. ing, and of that two sorts, the one whitish asinine, the other ruddy-
brown spotted with yellow specks ; the first has the *linea*, or side-
streak, from the gills to the tail quite white, the other of a browner
cast. The first is the *Astellus major vulgaris*, Raii, page 53, &c.
(*Gadus 4tus Artedi gen. Pisc.* 16, 4), between three and four feet
long, a fish, for the delicacy and firmness of its flesh, equal to most ;
the other we call commonly the Tamlin Cod, Red or Rock-Cod,
about two feet long ; the *Astellus major saxatilis seu rubens*, Jago,
in Ray, page 165.

Besides others mentioned by Mr. Ray^u, we have the poor or power, *Astellus mollis minimus* of Jago (Ray, page 163, N. 6) bearded as the *Astellus major*.

Of two-finned spinous *Afelli* (besides the useful hake and ling), the great forked-beard is to be noted ; it is eighteen inches and a half long, *Barbus major Cornubiensis cirris bifurcatis* (Jago, Ray, page 163), and the lesser forked-beard about five inches long, *Barbus minor Cornubiensis cirris bifurcatis*, ibid. Ray, page 154. These

^u The whiting pollack—Rawlin pollack, bib or blind-hadoc—Whiting. Ray, page 53, 54, 55.

two are seldom taken on our coasts, and therefore Mr. Jago reckoned them among the non-descript.

Of fish of the tunny kind, we have have the tunny, alias Spanish mackerel, the *Thynnus et Orcynus Autorum*: Mr. Ray saw one at Penzance seven feet long: It weighs sometimes one hundred pounds weight: It differs in nothing from the common mackerel, but that it is much larger, and has no spots. Ray, page 57.

The mackerel (*scomber*) is taken in great plenty on the southern coast of Cornwall, and not only of use when fresh, but is salted and pickled, and kept all the winter to the great relief of the poor. The coloured streaks of this fish are justly admired when it is dead, but greatly superior in beauty when it is living. When it is first caught, its colours are strong and lively; the streaks on the back of a full, dark, blue green, the general ground of a bright willow green; but as the fish grows fainter, and nearer its exit, the streaks lose their strength, grow paler, and the blue goes off: put the fish into a pail of sea-water it will begin to move, and, as the fish revives, the colours recover their lustre; take it out of the water, and the colours fade, and faint away as before. However inexplicable therefore that configuration of parts is to which colours are to be attributed, it is plain, in this case, that the height of the colouring is owing to the circulation of the juices in those fine capillary ducts and membranes of which the outward covering is composed; as the blood stagnates, the mass settles into a state of rest, incapable of reflecting the rays of light with equal vivacity: But whatever may be the cause, the varied, rich, and finished colourings of fish are strong instances how intent Providence has always been of diversifying her works, that they may make their way into our admiration through the eye, as well as gratify our taste. It was perhaps from the beauty of these colours that Ovid took the hint of representing the goddess of beauty, Venus, (during the general panick into which Typhæus had thrown the gods) as chusing to conceal herself under the form of a fish.

Among the slippery anguilli-form, we have the whistle-fish, the SECT. VII. rock-ling of Jago (Ray, page 164); in Cheshire, called a Sea-loche; *Mustela marina vulgaris*. Its icon is published from Mr. Jago by Ray, page 162; and besides others mentioned by Mr. Ray (page 73), I found on Careg-killas, in Mount's Bay, a particular kind of suck-fish, of which, as very different from the common *Remora* of authors, two icons may be seen of the natural size, Plate xxv. Fig. xxviii, xxix; the former shews the back, the latter the under and sucking part: the fish is smooth, and purple coloured.

Mr. Jago has added to Mr. Ray's Catalogue the smooth shan, *Cataphractus laevis Cornubiensis*, Ray, page 164. "Mulgranoco seu

Z z z

Bulchardo

Bulchardo Cornubiensi bene convenit, sed cirris bifidis differt." *Ibid.*
Fig. 10.

Of fish bifinned on the back with soft and flexible rays, a very rare one was taken in Mount's Bay, January 29, 1756: It is the *Dracunculus*, Rondel. lib. x. chap. xii. The oddness of its shape, and the beauty of its colour, induced me to give two drawings of it, Plate xxvi. Fig. x. and xi. It is generally reckoned a mediterranean fish, in which seas Mr. Ray found it; but scarce half the size of the Cornish one. It is also different from the icon of Rondeletius: its upper mandible projected much beyond the lower; it was sharp, bony, and bent forwards like the beak of a raven; its eyes large, close together, placed in the upper part of the head; its head large in proportion to the other parts, and somewhat compressed; the first *radius* of the anterior back-fin stiff, and reaching backwards as far as the tail; the fin high, wavy, triangular, with four *radius*'s; the belly-fin had the same number; it had four pectoral fins, two immediately under, and two posterior to the gills; they are horizontal at their insertions, from which one would imagine, that they were used in time of danger for flying^w; the body is round, tapering to a point at the tail, which is a fin of seven rays. When it was first taken, its colours were rich, yellow, pearl-colour, and blue.

Fig. iii. Plate xxvi. is the *Draco marinus* (*Rondeletii aliorumque*), in our seas scarce; it is badly designed in Willughby, who, as well as other authors who have described this fish, has not taken notice of the deep *fulcus* on the back, in which, as the ingenious Mr. Dyer, who sent it me 1757, observes, this fish can conceal the poisonous spines of his dorsal-fins when they are reclined, that he may exert them occasionally with the greater execution. I have given a drawing of it by the general scale.

SECT. VIII. Some fish bifinned on the back have the former fin radiated with prickly points, among which the baffe claims the first place; its elegant shape and compact structure (equally adapted for strength and agility) inclined me to give its icon from a large well-fed specimen, Plate xxvi. Fig. xix. This is the *Lupus* of most authors; the *Perca*, *species 7ma. Percarum Artedi*, page 69.

The mullet is generally taken with us in small nets near the shore.

Some of these fish are named *Cuculi* by the Latins, from the sound of the voice, which resembles that of the cuckow-bird, by the English called Gurnards (from their grunting like a sow, says

^w Mr. Ray, page 87, says the fish of the cuculine kind sometimes employ their fins to the use of flying, though chiefly designed for another purpose.

Ray (page 87); the voice of some is thought to resemble that of a pipe; it is therefore called in Cornwall a Piper. Of these we have the grey gurnard, the tub-fish, the red gurnard or rocket, the piper, the streaked gurnard (Jago, Ray, page 165); and that well-coloured fish, and excellent meat, the surmullet. What is called in London the Horse mackrel, the Cornish call Scad, a fish meanly accounted of; not so the doree (*quasi Deauratus*, or gilded fish, says Ray, page 99), the *faber*, *sive Gallus marinus authorum*. This fish is of firm substance, and much coveted, but rather dry in comparison of the sole and turbot*.

Of fishes not aculeated, single-finned on the back, we have the SECT. IX. comber, (Jago, Ray page 163) the herring, and the pilchard; the two last generally known; but the great profit of the Pilchard (of which more in the sequel) is in a manner peculiar to Cornwall, and more particularly from the river of Fawy westward. Besides these, we have the shad, or mother of herrings, (Ray, page 105) and the sprat or sparling, of which two sorts are observed in the Cornish seas, one the offspring of the pilchard, the other of the herring, and easily to be distinguished; some fishermen however think the sprats a distinct kind of fish from either, the belly of the one being smooth, of the other rough x.

Of the gar-fish, or horn-fish, there are two sorts in Cornwall, says Mr. Ray, (page 109) one called the Girrock, the other the Skipper, a fish which moves its upper jaw; “*Skipper Cormubien-sium corruptione vocis skopster rostro breviore quam Acus vulgaris, forsan Saurus Rendeletii*, lib. 8. chap. 5.” Jago, Ray, page 165.

Of fishes spinous, single-finned on the back, besides those found here by Mr. Ray, (from page 127, &c.) and those communicated by Mr. Jago, and published in the end of his Synopsis, (from page 163^y) we have a fish which, in Mr. Jago’s papers, I find called the Black-fish, and thus described: “It is smooth, with very small thin scales, insomuch, that they will not be taken notice of without close inspection; fifteen inches long, three quarters of an inch broad besides the fin; head and nose like a peal or trout, little mouth, very small teeth, a full and bright eye, only one fin on the back, beginning from the nose, four inches and three quarters, near six inches long, a forked tail, a large double nostril. Two taken at Loo, May 26, 1721, in the Sean, near the shore in sandy ground with small ore-weed in his pot.” As this fish appears to

* It is common on our coasts in the pilchard season, when you may buy of the largest at Penzance generally for about six pence each.

x See Hist. of Cork.

^y As the sea-bream, the chad or young-bream, the wrasse, butter-fish, the father lasher, the gold-finn, the cook, the corkling.

me very rare, I have given an icon of it Plate xxvi. Fig. viii. adjusted to the general scale from a drawing of Mr. Jago.

S E C T. X. It must not be imagined that the catalogue of fish given here in this chapter contains all the fish which are caught on the coast of Cornwall, but rather the most useful, most rare, and of remarkable properties, which have reached the knowledge of the author; it would be a very difficult task to make out an exact list; “*Immensa et summè admirabilis Dei potentia atque solertia in rebus cœlestibus, iisque quæ in aere et terra fiunt, maximè vero in mari, in quo tam variæ et stupendæ rerum formæ conspicuntur ut quærendi & contemplandi nullus unquam futurus sit finis*”*. Of the before-mentioned river-fish, the salmon, trout, and eel have the preference; of the flat sea-fish, the turbot, sole, and doree; of the long, the launces, and the conger; of the round, the cod; to which the whiting-pollack, whiting and ling are next, tho’ in taste and firmness inferior: the mackerel, mullet, and gurnard are well known; but for profit to the common-wealth of this county, the pilchard is deservedly esteemed above all. This fish comes from the north seas in immense shoals, and in the summer months, about the middle of July, reaches the islands of Scilly, and the Land’s End of Cornwall; not driven by fish of the cetaceous kind (as some have thought), but shifting their situation as the season prompts, and their food allures them; thus by a tour to the warm southerly coasts of Britain, they strengthen and prepare themselves and their young ones to return to the great northern deeps, for the sake of spawning and securing themselves during the stormy season. The pilchard continues off and on in the south chanel, principally from Fawy harbour westward, and is taken sometimes in great numbers at Mevagissy, in the creeks of Falmouth and Helford harbours, in the creeks of St. Kevran, and in Mount’s Bay; some pilchards are also taken in St. Ives Bay in the north chanel. With the taking this fish by seyne-nets and drift-nets, the curing them with salt, pressing them, (fuming them being for many years laid aside) and exporting them to foreign markets, the world is so well acquainted*, that I need only suggest in a summary manner the advantage which this fish is of to the county of Cornwall: It employs a great number of men on the sea, training them thereby to naval affairs; employs men, women, and children, at land, in salting, pressing, washing, and cleaning, in making boats, nets, ropes, casks, and all the trades depending on their construction and sale; the poor is fed with the offals of the captures, the land with the refuse of the

* Rondeletius, part ii. chap. xiv.

* See Carew’s Survey, page 33, &c.

fish and salt, the merchant finds the gains of commission and honest commerce, the fisherman the gains of the fish. Ships are often freighted hither with salt, and into foreign countries with the fish, carrying off at the same time part of our tin. The usual produce of this beneficial article in money, is as follows: By an exact computation of the number of hogsheads exported each year for ten years, from 1747 to 1756 inclusive, from the four ports of Fawy, Falmouth, Penzance, and St. Ives, it appears, that Fawy has exported yearly 1732 hogsheads, Falmouth 14631 hogsheads and two thirds, Penzance and Mount's Bay 12149 hogsheads and one third, St. Ives 1282 hogsheads; in all amounting to 29795 hogsheads: every hogshead for ten years last past, together with the bounty allowed for each hogshead exported, and the oyl made out of each hogshead, has amounted, one year with another at an average, to the price of one pound thirteen shillings and three pence, so that the cash paid for pilchards exported has at a medium annually amounted to the sum of forty-nine thousand five hundred and thirty-two pounds ten shillings.

It is still a matter of dispute whether fishes do hear; many learned men maintain the affirmative; and certain it is, that sounds are propagated in water. "All cetaceous fishes, says Artedi, (*ibid.* page 19) have the auditory passages externally apparent, but all other fish have none, and therefore seem not to hear. All fish are terrified indeed at the sounds of thunder, cannon, and such violent concussions of the air, which have a proportionable effect on the water, and the fish may become sensible of this by the general sense of feeling." But to this let me add, that though the generality of fish have no apparent auditory passages, yet they may have some small secret ducts (probably in their gills or mouth) thro' which they receive sounds, though in no very acute manner. Nature (by which name I always mean the wise Disposer of the natural and usual course of things) lessens, diversifies, and proportions the organs of this sense of hearing to the occasions of the animal, and the medium in which sounds are to move; if that be thin and light as air is, the auditory passages may be large; but if dense and turbulent as water, those passes must be small and well guarded, or they will be too violently agitated, and soon lose their tone: thus as Mr. Ray (*Creat.* page 152, edit. 8) observes, the amphibious or aquatic quadrupeds, such as the beaver, otter, phoca or sea-calf, water-rat, and frog, have very small ears or ear-holes suited to the frequent occasions they have to be in the watry element. Again: several fishes have their names from the sounds which they utter^b, from which I should conclude,

Whether
fish here.

^b As the gurnard, &c. from grunting, the cuckow, &c.

that the power of emitting sounds would not be given them, but for some use, and for what use, if they could not be heard and apprehended by fish of the same species? It is asserted however by some moderns that fish do not hear (Philos. Transactions for 1748, N°. 486); and so far the experiments mentioned there seem to prove, that fish are not perceptible of articulate sounds; and indeed it cannot be thought that their organs of hearing, formed for so thick a medium, need be so quick and delicate as those of creatures which live in the air; I think it therefore most reasonable to conclude that fish may, and likely do hear as much as is necessary for self-preservation, and that intercourse which is requisite to assemble and connect individuals of the same species.

SECT. XII. Besides the muscle, limpet, cockle, wrinkle, and crabs of all kinds, for better nourishment we have the long-oyster (the *Locusta marina* Aldrovand. de *Crustat.* chap. 2, tab. 2), and the lobster, or *Astacus verus*, much superior in delicacy of food to the former, and in such plenty on the coasts of Cornwall, that Well-boats come to load, and carry them alive to London and elsewhere^c.

Of the shrimp kind, great quantities are taken in Helford harbour, Mount's Bay, &c. in calm weather. Here we often find the hermit-shrimp, bernard, or *cancellus*, remarkable for taking possession of some empty shell, and there fixing his habitation as firmly as if it were his own native place; when it marches, it draws the shell after it; in danger retires wholly into it, and guards the mouth with one of its forcipated claws^d. That fine shrimp, *Squilla lata Rondeletii*, (lib. 18, chap. 6) *rubra*, *albo maculata*, I found on Careg-killas in Mount's Bay.

Of oysters there is great plenty in Cornwall; the best I have heard of come from the creeks in Constantine parish on the river Hél in Kerrier hundred; they have them also in all the navigable rivers on the south coast, always best tasted where there is least communication with the waters which come from mines, stamping-mills, and other places infected with mundic and vitriol. This fish has the power of closing the two parts of its shell with prodigious force by means of a strong muscle at the hinge, and Mr. Carew, (p. 31) with his wonted pleasantry, tells us of one whose shell being opened as usual at the time of flood (when these fishes it seems participate and enjoy the returning tide), three mice eagerly attempted to seize it, and the oyster clasping fast its shell killed them all. It not only shuts its two valves with great strength, but

^c In the spring and summer season the largest are bought for four pence each, sometimes less, in Mount's Bay.

^d Some have erroneously imagined that this was a young lobster.

keeps them shut with equal force, and (as I have been informed by a clergyman of great veracity, who had the account from a creditable eye-witness to the fact) its enemies have a skill imparted to them to counteract this great force. As he was fishing one day, a fisherman observed a lobster to attempt an oyster several times, but as soon as the lobster approached, the oyster shut his shell; at length the lobster, having waited with great attention till the oyster opened again, made a shift to throw a stone between the gaping shells, sprung upon its prey, and devoured it. The polity of sea-animals is it seems a state of nature, a continual war, where the fish in their several ranks have as many various arts of oppressing and devouring their inferiors, as of securing and defending themselves from their more powerful antagonists; all impressed by their gracious Maker for their mutual and respective preservation. We find not the same universal enmity between the greater and less of terrestrial creatures. Some antipathies indeed, some few carnivorous birds and beasts of prey there are by land, but in the sea the eggs, the spawn, the fry, the small, the weak, are in their several degrees the common and constant prey, food, and support of the greater, older, and more powerful. Why then are such different appetites implanted? Why do not the land-animals prey upon one another with equal eagerness? Why, there is less need of animal-food on the land than on the sea, because vegetable food is every where at hand on the surface of the earth, and the provident care of man can preserve in one season what does not grow but will be equally wanted in another; the marine vegetables are more sparingly given, in less variety, at greater depths, subject to the violences of their native element; the medium which fish live in is more boyant, and consequently the life more erratick than that of land-animals; their digestion also for the generality (from the coldness of the medium they live in) is less able to bear the toughness and harsh salts of marine plants; fish therefore must have other supports, and the animal food is dispersed in every creek and cranny, as the rich and proper nourishment of the finny race. This occasions a vast consumption 'tis true, but the provision nature has made is equal to it, the fecundity of fish exceeding all conception.

Of the cetaceous kind there are but few fish, and their eggs few; in the cartilaginous betwixt fifty and one hundred eggs; but in all oviparous fishes (of which class most fish are) the eggs are scarce numerable^e, there being found in one cod (it is said^f) 9,344,000 eggs.

Of shells we have great quantities, but rather more *varieties* than SECT. XIII.
sorts on our Cornish coasts. The finest are generally small, and in our Of shells.

^e Artedi de partib. Pisc. page 31.

^f Nat. Displ. 8vo, page 93, vol. I.

best

best, we cannot boast of the rich colourings which the shells of the Mediterranean and Indian shores afford the collections of the curious. Some however we have too rare and beautiful to be passed over in silence ; those most worthy of notice, which have fallen in the way of my observation, are the following :

Plate xxviii. Fig. i. Of the univalve kind, we have the blue-rayed limpet, or the oval pellucid limpet, dotted with blue lines lengthways from the vertex to the margin ; *Patella minima, lœvis, ovata, pellucida cœruleis a quatuor ad novem lineolis elegantissimè insignita.* From Falmouth Harbour and the Land's-End.

ii. The radiated beaked limpet with an oval *apex* ; *Patella radiata, inflato apice pustulato & albescente.* From Whitsand Bay.

iii. Rough-ridged limpet ; *Patella striis rugosis, aspera, apice acuminato.* Mount's-Bay.

iv. The fool's-cap, of a pale blossom-colour, rarely found on the English shores ; when taken up with the animal in it, there is a membrane at its margin by which it adheres to the subject it chooses to settle on. From the Land's-End and Heyl Mouth. *Patella rugosa, alba, vertice admodum adunco.*

v. Smooth tooth-shell, the case of a sea-worm ; *Dentale lœve, curvum, album.* Land's-End.

vi. The wavy striated trochus, pearl-coloured ; *Trochus acuminatus, crebris striis transverse et undatum dispositis donatus.* Gwythien sands.

vii. The pearl-coloured, striated, papillaceous top-shell ; *Trochus planior, creberrimis striis splendidis papillaceis donatus.* Ibid.

The *Nautilus* is very rare in Cornwall, and the *Voluta* of the specimen which I have, not three quarters of an inch diameter.

The white ruddy-spotted snail with a circular mouth ; *Cochlea alba, Lunaris, rufescens fasciis maculatis distincta.* Ibid.

The smooth flat-twirled river-snail ; *Cochlea semilunaris, lœvis, spirâ undâ tantum maculatâ distincta.* Ibid.

viii. The cornu-ammonis snail ; *Cochlea cornu-ammonis.*

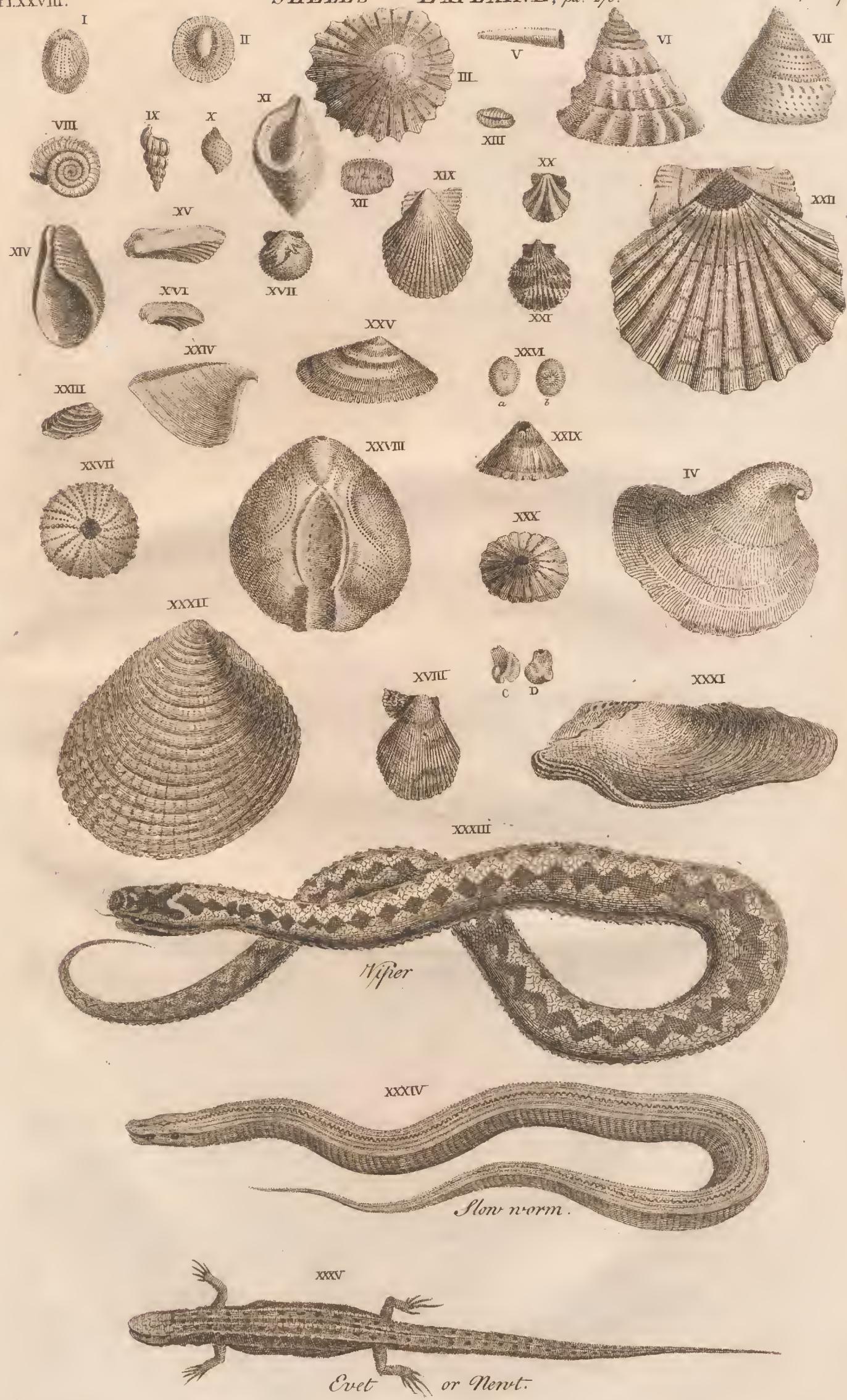
ix. The high striated white cochlea, or bastard ventle-trap ; *Cochlea alba, striis raris admodum eminentibus exasperata.* From the Land's-End.

N. B. The famous ventle-trap, sold lately at London for eighteen guineas, was a species of this kind but larger, and the parts less connected with the body.

x. The yellow canulated whelk with black furrows ; *Turbo^s luteus, septem sulcis parallelis nigris distinctus.* Land's-End.

The small red and white variegated whelk ; *Turbo minimus, lœvis, variegatus, albo-rubicundus.* Whitsand Bay.

^s Or Turben.



To William Oliver of Bath,
variety of Cornish Shells & Reptiles



Cantab: & Oxon: MD: FR: S. this
is with great respect inscribd by
Wm. Borlase.

Small milk-white smooth whelke; *Turbo minimus lœvis albus*.
Ibidem.

The small needle whelke; *Turbo minimus, subfuscus, acūs instar acuminatus*. *Ibid.*

Fig. xi. The purple-marking whelke. From Mount's-Bay and Loo. The juice which marks is in a separate bag, of a yellowish green when first drawn upon linen, grows a little ruddy afterwards, till it comes to a faint purple; when dry, and the linen washed, it is of a good purple, and rather betters by age and frequent washing.

xii. The purple, spotted Nuns, alias courie; *Concha Veneris exigua, purpurascens striis minimis transversis, tribus maculis fuscis dorso inspersa*. Heyl-Mouth.

xiii. The smallest Nuns without spots; *Concha Veneris minima nullis maculis insignita*. Whitsand-Bay.

iv. The larger-striped *Concha Veneris*; *Concha Veneris major (Listeri Hist. Conchyl. lib. 4, sect. 9, N°. 71) lœvis, lineis luteis, et albis densè distincta, aperturâ longe inæquali*. *Ibid.*

It is very curious to observe how this shell-fish proceeds to its maturity: it is here in its infancy, but it narrows this wide opening, and gradually buries the *voluta* of its *apex*, as it contracts its aperture, till it arrives at the state of a perfect courie, when it throws all the after-thickning of its shelly-increase from its sides round to its back, where the joining of the two testaceous *apophyses* may be plainly perceived ^h.

Of the bivalve kind worth notice the following only have occurred:

xv. The quadrangular striated muscle; *Musculus, [aperturâ fere quadrangulare] striatus, fasciis undatis subfuscis depictus*: alias, *Musculus Matthioli, lib. 3, N°. 208*. From the Land's-End.

xvi. A smaller, less-distinct specimen of D°. very rare in the English seas, usually reckoned a Mediterranean shell.

xvii. The smooth foliaceous purple concha; *Concha lœvis, verice foliis quasi insignito, ad marginem leviter purpurascens*. Whitsand-Bay.

xviii. The winged scallop; *Pectunculus pennatus striis densè notatus, luteo-purpurascens*. *Ibid.*

xix. The rough echinated scallop; *Pectunculus echinatus, [fuso-purpureus] concha echinata Rondeletii, Gesneri & Aldrovandi*. *Ibid.*

xx. The regularly-marked scallop; *Pectunculus lineis albis & luteo-rubicundis ordinatim distinctus*. *Ibid.*

^h I am obliged to the curious Mr. Jos. Platt of Oxford for this and other kind communications from his large collection.

Fig. xxii. The purple scallop variegated with white circular fillets; *Pectunculus purpurascens vittis albis circularibus variegatus*. *Ibid.*

xxii. The purple ribbed scallop; *Pecten altis striis albo-purpureis, transverse variegatis insignis*. Helford Harbour.

xxiii. The light purple *tellina* with horizontal *striæ*, eminent, and parallel to the margin; *Concha in vertice leviter purpurascens striis eminentibus margini parallelis distincta: Tellina tertia Aldrovandi ut videtur.*

xxiv. The white crooked-bill bivalve of the bernacle; *Concha lœvis candidior, triangularis, vertice admodum reflexo et acuminato*. Whitsand-Bay.

xxv. The polished *tellina*; the fillets disposed at different distances, but of an equal breadth throughout as to themselves, with a serrated edge; *Tellina vittis albo-luteis & purpurascientibus leviter striata, margine serrato*. *Ibid.*

Tellinæ varie radiatæ, fasciatæ, vittatæ, lœvigatæ, asperæ, sulco-striatæ pulcherrimæ, et Chamæ parvæ (ut plurimum tamen ad littora Whitsand-Bay) sunt frequenter repertæ.

xxvi. The flat, smooth, small sea-egg; *Ovulum marinum lœve, minimum, figuræ compressæ*, or, *Echinus marinus minimus*: *a* the back, *b* the belly. Mount's-Bay.

xxvii. The round and flat sea-egg; *Echinus marinus rotundus, figuræ compressæ, papillis minimis, spinis spoliatus*. We have them in the Mount's-Bay from $4 - \frac{1}{2}$ inches high and five inches diameter, down to one eighth of an inch high, and two eighths of an inch diameter.

xxviii. The depressed cordate sea-egg; *Echinus marinus depresso-cordatus*. Mount's-Bay.

xxix. The narrow-mouthed balanus; *Balanus ore contracto, cinereus*. Mount's-Bay. The elevation xxix, the plan xxx.

The wide-mouthed balanus; *Balanus ore biante magnus*.

xxx. One valve of the pholas taken out of the middle of a stone at Karn-Jenny, Mount's-Bay.

xxxii. The wrinkled, notched, and high-beaked concha or cockel; *Concha cinerea densa, margine dentato, striis rugosis et e lateribus undosè tuberculosis*. Heyl-Mouth. --- C, D, are the two shells of the jaw of the *teredo*, or auger-worm, with which it eats its way into timber and stone; they are sharp, and turned screw-wise one over the other for boreing. Found at Heyl-Mouth, 1756, in fir-timber, by the Reverend Mr. Williams of Glamorganshire.

SECT. XIV. There being such quantities of recent shells on the coasts of Fossil-shells. Cornwall, it might reasonably be expected that extraneous and fossil-

fossil-shells, such as *pectunculi*, *conchites*, *ammonitæ*, and other remains of marine testaceous animals should be found in proportionable plenty in stones, quarries, and mines; but thoseⁱ who have travelled through Cornwall, have found no such thing: and strange this may seem to some, if not an unaccountable deficiency; yet in this particular we shall not find Cornwall singular, nor the subject sufficiently examined. True it is, that fossil-shells are extremely rare in Cornwall, and I have sometimes thought that the shape of our county might have contributed in a great measure to deprive us of these curiosities; for being a narrow slip of land, projecting into the western ocean, the departing waters of the deluge could not retire to their usual bed without taking away great parts of the upper *strata*, as a modern author has observed^k; to which let us add, that the seas to the north and south of Cornwall could not leave the surface of our hills without frequent struggles, as we see on ridges where two seas meet: they must have produced, from their own weight and concourse, such violent agitations as would not leave such light bodies as shells, seeds, plants, and animal exuviae to rest in the dissolved clays and soft stones of such a narrow ridge. But I am persuaded that this is not the reason; for in other counties, and indeed foreign regions, where the shape of the country is quite different, and does not at all countenance such a theory, we find the same want of these extraneous fossils. First, then, let it be observed, that these marine *exuviae* are not equally dispersed in every place; in many districts few or none are found, in many districts again they are found in all parts; the reason of which is, that the testaceous tribes do sometimes shift, retire, and disappear from some coasts, and must be therefore accumulated in others. The *murex*, so famous formerly on the coasts of Tyre, has been unknown there for many ages. Fossil-shells (says Dr. Shaw, page 383) are very rare in the mountains near Sinai; they are still rarer, if Fame says true, in many parts of Asia minor, where a celebrated Botanist of our country, notwithstanding the utmost enquiry, could not hear of any in much larger districts than the county of Cornwall. *Nobilissimus Sherardus Botanicus afferuit quod in orientalibus platis ab ipsomet nulla spreta industria in fossilem disquisitione, praeter suam & aliorum expectationem nullum unquam diluvianum monumentum comperit.*" *Jos. Monti Bononiensis de monumento diluviano*, page 24. "For as in our mountainous places (continues the same author) there are observed whole mountains of testaceous *exuviae* stretching themselves in a straight line for many miles together, as Count Marsilli has frequently informed me; so

ⁱ Ray, Lhuyd, Hutchinson.

^k Hutchins. vol. I. tract 2, page 90.

also

also 'tis reasonable to suppose, that by the rapid waters of the flood, matter was carried to and fro, and deposited over large tracts of land little or nothing charged with marine bodies." This scarcity may be accounted for by very satisfactory reasons: The distribution of recent marine bodies is, and always has been unequal. Why then should fossil-bodies of like kind be dispersed with greater equality than the recent? Where there was plenty of testaceous animals at the time of the flood, there, or near by, plenty of fossil-shells deposited in clay and stone is found; where there was a scarcity of recent shell-fish, there few or none appear inclosed in the solids. In some places, by a variety of concurring circumstances, the shell-fish were, and are still collected and heaped together; other places must in proportion have been, and still are left naked and destitute. Either there was a deficiency of recent shell-fish round the shores of Cornwall, or there was not: if there was a deficiency of shell-fish round the shores of Cornwall at the time of the deluge, then it is no wonder that none should be found in a fossil state; if there was not such a deficiency, then shell-fish must have overspread the hills of Cornwall, as well as elsewhere, in proportion to the product of the neighbouring shores; and the reason why they do not now appear is next to be enquired into; and may probably be, first, because our waters are very sharp and corrosive, subject to much vitriol, as appears by our copper-lodes, in which there is frequently found more or less of copper dissolved and precipitated by vitriol. The waters of tin-lodes and workings are also well stocked with vitriol. Now waters impregnated with the sharp salts of vitriol, and such a multitude of minerals and metals as Cornwall abounds with, must soon have dissolved the shells which were deposited here by the deluge; and I am the more inclined to believe that the corrosive quality of the Cornish waters may have consumed those testaceous *exuviae*, because in Cornwall we have various evidences of the flood, but all of that kind and texture which are proofs against such fretting waters. In a cliff four miles north of Boscastle, there are several *strata* of white crystalline stones, about four inches diameter, inserted in horizontal rows like a list or chain of single pebbles side by side, Plate xvii. Fig. iv. *a a*: these lists were fixed in the general *stratum* of this country, which is a brown flat, and could be spread in this manner by no cause so likely as the general deluge. A little to the south, in the same cliff, I observed veins of different colours, from the top of the firm rock to the foot of the cliff washed by the sea, not in a perpendicular but angular direction, and yet preserving a parallelism one to another in a zig-zag manner, as represented Plate and Fig. ibid. G W; a phænomenon plainly intimating the oscillatory motion with which the

sordes,

sordes, dissolved by the flood, was agitated in some parts before it settled and finally concreted: I pass over the shodes and pebbly *strata* of Porthnanvan (as already set forth, pages 76 and 150), though equal evidences of the deluge. Again: In other countries, where their waters are plentifully charged with suspended spar (usually termed petrifying waters), the shells settling in the *sordes* which the deluge had every where produced, and afterwards deserted, were either immured in new forming stones of lime and marble, or the *nidus's* they formed were filled with stones or semimetallick concretions. It could not be so (at least so frequent) in Cornwall where spar is very rare; petrifying waters few or none, and the base of our stone mostly *quartz*. There are in other parts some figured fossils in flinty nodules, as *echinites*, &c. but flints are so scarce in Cornwall; that it has been till now doubted whether there are any native in the county: there are however some (see page 106), but being broke, I have not as yet found any marine *exuviae* in them. Again: In chalky *strata* many of the tenderest shells (such as spines of the *echinus's*, &c.) are preserved in great quantity, but in Cornwall we have little or no chalk. When we consider therefore the mineral impregnation of our waters, and the hard crystalline basis of our Cornish stones, incapable of yielding to the waters of the flood, and the scarcity of spar and chalk, we shall not think it strange, that so small a district as this county should have few extraneous fossils to boast of. But after all, it is very certain that we have some marine and extraneous productions inclosed in our Cornish stones, although they did not occur to the learned gentlemen before-mentioned during their short visits to this county. One cast of a shell in mundic, and some vermicular remains, may be seen Plate xv. page 137, Fig. xiii and xiv, and Plate xvi. page 141, Fig. lii, lv, and lvi. Some plant-like casts in the same semi-metal may be seen, ibidem, from Fig. xxix to Fig. xxxiii. from my own collection, and probably many other sorts, vegetable as well as terebraceous, may occur to others among our minerals. The most likely places to afford them in stone to a diligent enquirer, I take to be the northern coast near Lower St. Column and the shore of Cuthbert, Carantoc, and Piran sands, where we have alabaster, stalactites, and the sand-stone, in which last I find bits of flat: the hart's horn also (Plate xxvii. Fig. v.) was extracted, in the year 1752, from the middle of a rock of this Cornish free-stone, at New-Kaye, in the parish of Lower St. Columb, Cornwall, (see page 95) which I therefore give in its natural size as it was taken out, the letter G marking the incision made by the pick-axe of the stone-cutter who found it. The scrapings became dissolved in vinegar, which pure hart's-horn, put into the same acid, would not do: the horn had lost its natural

toughness, and was become gritty, cutting short like chalk : it was hollow in the middle, the medullary pith being eaten out, and the sides of the hollow more corroded than the outside. This intimates that there is spar suspended in the waters of our northern coast which cemented these sands into stone, though indeed in that stone I can perceive no shells, after examining them minutely in the microscope. On the southern coast it is very probable that Falmouth Harbour (where there is such plenty of coral, a substance little different from the nature of spar) may afford us some specimens of fossil-shells ; for I have now before me a lump of spar seven inches long, three inches and a half wide and deep, with limpets, pectuncles, sea-eggs, whelkes, oysters, muscles, cockles, and some testaceous and coralline fragments mixed throughout in the body of the stone ; all small, except the muscles, which were of several sizes : this lump was not fixed in any natural rock, but lay as a detached nodule on the strand near the mills betwixt Falmouth town and Pendinas castle ; it may not therefore carry all the evidence that it would have done if found farther from the sea, and in a quiescent *stratum* ; but it must be acknowledged, that it could not come from far by reason of the roughnes of the surface ; and forasmuch as it contains no shells or fragments but what are common to this harbour, it is most likely to have been the product of the neighbouring cliffs. At the Par, near Fawy, there is a lime-stone not very unlike the substance of a coarse coral ; it is much eaten by the Pholades and small worms, with the shells of several pipe-worms affixed, of a substance very little different from the stone itself. This stone makes a strong effervescence with *aqua fortis* ; and if there be not much spar-stone in this neighbourhood, most probably these worm-eaten stones have been imported from other parts for making lime, and being dispersed in the sands and sea, have been seized by the pholades of this coast.

C H A P. XXIV.

Reptiles.

SECT. I. **O**F reptiles, we have the adder or viper, usually about two feet long, of which the icon may be seen Pl. xxviii. Fig. xxxiii. p. 276. Its bite is attended with immediate swelling, and dangerous if some remedy be not soon applied. Sallad-oil, taken internally, as well as externally rubbed on the wound, is reckoned a salutary method of proceeding ; but the first thing to be done, says Dr. Mead¹, upon

¹ Of poisons, page 42.

the

the bite of a viper of any kind, is, that the patient, or some one for him, should immediately suck the wound, having first washed his mouth with warm oil, and holding some of this in his mouth whilst the su^ction is performing, to prevent any inflammation of the lips and tongue from the heat of the poison, after which the said learned author prescribes emetics worked off with oil and warm water :" but without these precautions (which do not always occur to persons in haste, and in torture), it is certainly very dangerous to suck the poison ; Matthiolus gives us an instance^m of a person who having his finger bitten by a viper, in the agonies of death put it in his mouth, with the blood sucked in the poison, and died on the spot. It may not be amiss therefore in this place to suggest a more harmless remedy, administered by a good Lady of my neighbourhood^{*} : ---- A man, falling asleep after mowing in the garden, had his breast stung by an adder ; waked by the pain of the wound, he shook off the adder from his shirt, and immediately applied to the Lady of the house ; she ordered a young pigeon with its *anus* close to the wound to be applied ; the pigeon (whose reciprocal contraction and dilatation in those parts is well known) soon swelled, sickened, and died ; a second pigeon was administered to the place infected in like manner, and kept close to the breast for some time, till it grew faint, and could draw no more ; the man was entirely cured, and the second pigeon was found dead the next morning.

On the northern coast of Cornwall, about Stratton, I had a snake ^{Snake:} brought me : It differs from the viper in the western parts of this county in that it is larger, of a browner colour, not so soon incensed, nor so poisonous : It is very prolific, and generally lays its eggs in heaps of rotten horse-dung ; out of one heap of which, as I was informed by my host at Kilkhampton, he had seen, at the Barton house of Lancel near Stratton, three hundred taken out at one time. The same person some years since killed one snake four feet two inches long, and proportionably thick : my guide also from Kilkhampton assured me, that he had this year (1757) killed one about four feet long. The country people have remarked two sorts of them ; one sort has a white garland round its neck, with a sharp tail like the point of a rush ; the other sort has a yellow garland, with a shorter and more obtuse tail.

In the islands of Scilly they have neither adder, snake, or any of the serpent kind ; whether the earth is here too salt, for Pliny observes, and to him assents Dr. Plot (Oxfordshire, page 191), that brackish earth is freer from vermin than any other) ; or whether the lands

^m Wolfgang. Franzius Animal. Hist. page 519.

* Late Mrs. Basset of Tehidy.

are too cold and barren, snakes being bred out of hot, fat mould, and mud, and lurking in low, rich, shady grounds^a, under long grass, of which in these little islands there is no abundance. It is observed by some^b, that on one side of a river there are many serpents in summer, but on the other side not one; and if they are brought over, they immediately languish, and die in a few hours.^c No wonder then that there are snakes in Cornwall and none in Scilly, when their choice of and aversion to particular soils is so capricious. There are no snakes near Badminton in Gloucestershire, and the cause assigned (Plot's Oxford. page 195) is, that it is an open country; it wants that shade and shelter which they delight in.

We have a kind of viper which we call the Long-cripple: It is the slow-worm or deaf-adder of authors, its bite poisonous, but not near so invenomed as that of the viper: however, I am credibly informed, that at Mr. Powis's, in Oxfordshire, near Reading, a man about six years since being by this creature bitten in the arm, lost his life by it. Its icon is given Plate xxviii. Fig. xxxiv. This is of the pointed-tail kind: there is another sort common about Loo and in the eastern parts of this county, obtuse at the extremity as if truncated.

Of the lizard kind we have the newt or evet, which, from its four feet, the Cornish call *padzher pou*^d. It is generally found in crofts of furze in the summer months: it is not venomous, nor with us found generally in or near water. Its icon may be seen Plate ibid. Fig. xxxv.

Among the quadruped reptiles we may reckon the seal or sea-calf, vulgarly called in Cornwall the Soyle, in Latin the *Phoca*, or *Vitulus marinus*. It is common in the caves and on shores of Cornwall which are least frequented: it is five feet in length, sometimes seven; his head somewhat like that of a calf. Its pectoral-fins resemble the fore-feet of quadrupeds, with five toes connected by a membrane with which, when in danger, it will throw stones very plentifully at those who pursue: the tail is horizontal, and supplies the want of fins in the hinder parts. This creature is amphibious; it cannot altogether live in the water, but requires successive intervals of rest and respiration on the land. The poor people on the northern coasts of this county, in times of scarcity, do sometimes eat the flesh, and indeed the flesh of the seal as well as of the porpesse in former ages was admitted among the dainties of the most luxurious feasts^e, but in general the seals are killed not for their flesh, but for their lasting, useful, and spotted skins, and

^a Brit. Bacon. page 73.

^b Pontopp. part II. page 36.

^c That is, four feet.

^d Philosophical Transactions for the years 1751 and 1752, page 17. Leland's Collectanea, volume the sixth.

the oil and fat which their bodies afford. It is supposed that the fabulous relations of mermaids and mermen might first arise from observing this creature at sea in an erect human-like posture; for whether it is delighted with music or any loud voice, as Mr. Carew says, (page 35) or whether it is to alleviate the toil of swimming, it shews itself almost wholly above water frequently, and near the shore, ibid. Add to this that the great docility of this creature (little short of that of the human *species*), and his being so easily trained to be familiar with and obedient to man¹, may make us with some grounds conclude, that this is the creature to which imagination has given the shape of half-fish half-man, a shape nowhere else to be found. The cunning of this creature to free itself from its enemy is remarkable, if what is related be true: The seals are in great plenty in the Baltic; when the Russes hunt them, they surround sometimes three or four thousand together, which the seals perceiving, pile themselves up in a heap, by that excessive weight striving to break the ice on which they have been surprized, and so escape their enemy². The *manati* of the Indians, or *Vacca marina*, (Ray's Quadrup. page 193) by Artedi (G. Pisc. page 109) called *Trichechus*, is only a larger sort of this kind from ten to fifteen feet long, and sometimes thirty-five feet in length³.

The turtle is no native of such northern coasts as this of Cornwall; however there were two caught on our shores in the year 1756. That exhibited here, Plate xxvii. Fig. iv. was caught by the *drovers* in their mackerel-nets four leagues south of Pendinas castle, and brought to Truro alive July 3, 1756. It had seven spinous ridges in its shell, six fins⁴, fleshy, without nails, flat and smooth, (not in large scales, as Rondeletius's) of a bluish colour without, but within (that is, on the under-part) ruddy, flesh-coloured, speckled with dark spots, as was also the under-part of its neck. It was adjudged to weigh eight hundred pounds weight. It was six feet nine inches from the tip of the nose to the end of its shell, ten feet four inches from the extremities of its fore-fins, extended. Its shell is like that of the *Testudo Coriacea, sive Mercurii*, of Rondeletius, page 450. There was another turtle taken at the same time by the *drovers* off the Land's End, which weighed six hundred and three quarters after it was bled to death.

¹ Of which see Philosophical Transactions, ib. page 113.

² See Leigh's Lancashire, page 131.

³ Phil. Trans. for 1751—2, page 114.

⁴ As the fishermen informed me, and to me

they made the appearance as in the drawing; but the body was so heavy, and the boat so full, that I could not get the fishermen to turn it so as I might observe it more particularly. N. B. Rondeletius's icon, lib. 16, chap. 4, has but four fins.

C H A P. XXV.

Of Quadrupeds.

S E C T. I.] **T**HE sheep of Cornwall in ancient times were remarkably small, and their fleeces so coarse that their wool bare no better title than that of Cornish hair, and under that name the cloth made of that wool was allowed to be exported without being subject to the customary duty paid for woollen-cloth. When cultivation began to take place, and the cattle to improve in size and goodness, the Cornish had the same privilege^w confirmed to them by grant from Edward the Black Prince (first Duke of Cornwall after the Norman conquest) in consideration of their paying four shillings for every hundred weight of white tin coined; the same privilege of exporting cloth of Cornish manufacture duty-free, was confirmed to them by the twenty-first of Elizabeth^x. At present the eastern parts of the county finding themselves under a necessity (from the scarcity of tin) of applying themselves to tillage and pasture, from the rivers Alan and Fawy eastward have as large and fine-woolleyed sheep as any where in England, and the common people wash, card, and spin their own wool, and bring their yarn to markets^y. In the neighbourhood of St. Columb, in Rôsland, and St. Kevern, their sheep are large, and bring a great price, but the sweetest mutton is reckoned to be that of the smallest sheep, which usually feed on the commons where the sands are scarce covered with the green-fod, and the grafs exceedingly short; such are the towens or sand-hillocks in Piran-sand, Gwythien, Philac, and Senan-green near the Land's-End, and elsewhere in like situations. From these sands come forth snails of the turbinated kind, but of different *species*, and all sizes from the adult to the smallest just from the egg; these spread themselves over the plains early in the morning, and whilst they are in quest of their own food among the dews, yield a most fatning nourishment to the sheep.

In some of the hilly, rocky districts, we have goats, the kids of which fatten in their season without trouble, and are brought to market.

S E C T. II. In coarse grounds the black-cattle are small, and live mostly (especially in the summer months) upon the heath and furze; but in large tenements where the soil is improved, and the owner chuses to

^w Which they had before, "from auncientie," says Mr. Carew, page 24.

^x Camden's Annot. page 8.
^y At Lanceston, Camelford, &c.

breed

breed them, the Cornish have as large cattle as elsewhere, and with these the markets are well supplied, particularly in the larger towns^z.

The calf is sold generally too soon to the butcher to make fine veal, an inconvenience owing to the multitude of inhabitants, and the quick demand there is for the milk and butter of the dam.

To make butter, the cream is not skimmed off raw, as it naturally rises to the surface of the milk; but after it has rested in the vessel about twelve hours^a, the milk is scalded in an earthen pan, over a slow gentle fire, till it is as hot as a person can well bear his finger in, by which means the cream, settling into a wrinkled furrowed pellicle about a line thick, grows hard and *clouted*. This method of managing the milk is peculiar to Cornwall, and some parts of Devonshire; but unless much caution and neatness be used in cleaning the vessels, and ordering the fire, is very apt to give a smoaky, earthy taste to the butter, soon perceived by and disagreeable to travellers: it must be observed also that the fire does not increase the quantity of butter; for by experiment of the same quantity of milk drawn at the same time from the same cows and pasture, the raw cream made ten ounces and three quarters of butter, the scalded cream made only nine ounces and a quarter; the raw cream therefore yielded above one seventh more of butter than the scalded: this way of scalding does however soften and meliorate the remaining milk by evaporating, as I imagine, the acrimonious parts; the hard cream also preserves the milk from souring, of which the Cornish common people are so sensible, that they will eat the scald-milk readily, but the milk from which the cream has been skimmed raw, they will scarce taste.

The black-cattle sometimes generate very soon; a calf before she was twelve months old having produced, in 1752, another calf at Castlehornek, in the parish of Maddern, and no material inconveniency ensued; she proved a sizeable cow, and had store of milk, which is the more extraordinary, because such premature conceptions usually prevent the growth, impairing the alimentary as well as generative passages. Dr. Plot gives us instances of the like early fecundity both in Oxfordshire and Staffordshire.

Cattle have not only their unusual and early, but sometimes their monstrous productions, of which the most remarkable, which has reached my notice, was a calf cast in the tenement of Kallestek in Piran-sand, in the month of May 1751, by a cow of Thomas Hodge: It had two heads, conjoined; four ears, four eyes, four nostrils, two mouths, and two back-bones on the fore-part, which

^z Bodman, Helston, Penzance, &c.

^a Some keep it two days (in the winter) be-

fore they scald it, in order to have the more cream.

came

came into one about two thirds of the back, thence continued as one to the tail ; one tail, four legs ; it had two hearts, two livers, and all the inwards double, except the *primæ viæ*, from the stomach downwards, which were single. It lived four hours, and cried and lowed with two voices at the same time. Its figure may be seen Plate xxiv. Fig. xvii.

Other anomalous productions this *species* of animals might afford us ; but as Nature pleases most when she sticks to her own rules and proportions, her few accidental deviations, deformities, and monstrous births, have their sufficient and perhaps intended use, if they awaken our gratitude, and make us more attentive to her customary and almost uninterrupted symmetry and gracefulness.

S E C T. III. *Horses.* The Cornish horses in general, though of no great rising, are remarkably strong-limbed ; and as our highways are for the most-part rough, hard, and stony, much more serviceable and sure-footed than those more-fightly ones which are brought from the eastern counties : Formerly they were so small in stature, that they were seized upon as unstatutable ; for, by the statute of the 12th of Henry VIII. every man might seize upon horses depasturing commons, if they were under a certain size^b. They are at present rather small, or but middle sized, especially in the coarser and more hilly grounds ; but they are so much more hardy than others, that they bring a large price, and a strong, punch, and spirited horse, is with us generally called a Gunhill, from a wild downs of that name (stretching almost from Helston to the Lizherd Point) anciently famous for such little horses.

S E C T. IV. *Deer.* In this county formerly there was such plenty of Deer, that besides those of private gentlemen, the Duke of Cornwall had one chace or forest, and nine parks*. Henry VIII. disparked four of them at once, *viz.* Cary-bullock, Liskerd, Restormel, and Lanteglos, near Camelford^c ; and at present the Duke has no deer-park. The present parks are those of Godolphin, belonging to the Earl of Godolphin ; Tre-gothnan, to Lord Viscount Falmouth ; Lanhidroc and Pinchley, both to Mrs. Hunt ; Boconeck, to Tho. Pitt, Esq; Caryhayz, to William Trevanion, Esq; Pencarrow, to J. Molesworth, Esq; Trevetho, to Humphry Mackworth Praed, Esq; Place, to Humphry Prideaux, Esq; Tehidy, to Francis Bassett, Esq. A great part of Werington Park (seat of Humphry Morice, Esq;) is also in Cornwall.

Red deer are seldom seen in this county ; some however make their appearance for a time on the hilly downs about Bodman,

^b Car. page 24.

* Doderidge, p. 118, of the Dutchy of Cornwall.

^c Formerly belonging to the ancient manor of Helston (alias Hellebury) there.

whence

whence they haunt the woods upon the moors^d: they are found in greater plenty in the north betwixt Lanceston and Stratton, as if they were apprehensive of wanting room to range if they advanced into the narrow western parts.

Of badgers, otters, hares, foxes, rabbits, and other wild inferior quadrupeds, Cornwall has its share, but nothing particular: I shall only observe, that they will get rid of their wildness by time and gentle usage, of which tame foxes which have been trained up like spaniels to attend their master, and rabbits used to chambers, frequently convince us; but the most remarkable instance I have met with of the force of custom in this point, is that of a hare, which had not only shook off its wildness, but the fearfulness so natural to, and almost inseparable from this creature: It was so familiar, that it took bread out of my hand the first time I saw it^e; it lay down under a chair in the parlour, and was in all respects as gentle, free, and easy as a lap-dog: It went out into the garden now and then, and after regaling itself with the herbage, returned into the house as its proper habitation. The master^f had an old spaniel and a greyhound, both so fond of hare-hunting that they would by concert go out together frequently upon the scent, and had been observed to kill many hares without the direction of huntsman or other assistance; the greyhound in particular was once discovered by a neighbour following his master (who knew nothing of it) with a hare in his mouth; with these two dogs, so fond of their usual prey at other times, the tame hare spent his evenings by the same fire, and frequently rested in their bosom.

It is said^g, that even a Norway bear has for many years been known to follow the herds of cattle like a sentinel, and to stand tamely by, as the maid was milking, and that he always drove the wolf away. The same author informs us, that the otter may be made tame, and used to a house, by being fed with milk, and become in time a daily fisher for his master, go out on command, and bring in one fish after another into the kitchen*.

Other properties of brutes are still more worthy of our notice. First, S E C T . VI .
The great variety of shape and colour observable in the quadrupeds prevents any two from being exactly alike, as much as the human features distinguish mankind one from another. Wherefore then The prop-
erties and use
of quadru-
peds.
was this variety bestowed upon brutes? Are they at all sensible of such diversity? Are they the more happy, or more useful to one

^d Leland mentions them, vol. VII. page 117,
about Dofmery Pool.

^e August 20, 1738, at Illogan parsonage.

^f The Revd. Mr. Newcomb, Rector of Illogan.
^g Pontopp. part II. page 14.

* Ibid. page 27.

another for it? No. This variety then is doubtless intended for the sake of man, to prevent confusion, and decide and ascertain his property. As our next following subject therefore is man, it may not be amiss here to recollect the connexion and dependance which all the brute creation have upon him, and observe, that they are formed and adapted both by the properties of their bodies and mind to promote the labours, the food, the cloathing, the pastime, the safety, and delight of man: A great number of them cannot subsist in the winter, in storms and inundations, without the provident care of man; their respective excellencies, like metals in the mine; are of no benefit to the world, unless they are conducted and applied by man; they are of little use or pleasure to one the other, or to themselves, but for food and increase, of which the more greedy they are, they are but the more conducive to the advantage of man. I would not be thought to intimate, that they are meer machines, or that the only intent of their creation was to be subservient to man: God designed them no doubt to display his glory, and to be happy in their degree, and it is cruelty in man to give them pain wantonly, to impose labour without measure, and with-hold food and shelter from them without compassion; but their several properties plainly shew that they were designed to fill up the vacancies, if I may say so, of human nature. If man had the strength of an elephant or an ox, or swiftness of a horse, man must have had the limbs and shape too, the same bones and muscles. How much better is it now ordained? Man has not that strength and swiftness in his own person, but he knows where to find it, and when and whither to direct it: he has that reason which gives him the command not only of his own excellently constituted body, but of the superior strength and swiftness for which other bodies are better prepared, though infinitely short of the endowments of the human body. How orderly and proportioned to the necessities of human nature do the brutes come in, all in their turn, to supply what man wants; some by their strength and vigour^s assist him in works necessary or ornamental, yet beyond the reach of human force without such aids; some, by their swiftness as well as strength^h, transfer him from place to place for the sake of busines, or pleasure, or devotion; those remarkable for extraordinary fiercenesⁱ as well as strength (that they may not annoy and impede him in his designs), like noxious, poisonous herbs, are scarce, and far removed into spacious and scarce habitable deserts; there they have their use, feeding where, and on what other creatures will not, clearing the air of the infectious steam of carcasses, and least they should mul-

^s The horse, the ox, the ass, the camel.

ⁱ Lion, panther, leopard, &c.

^h The horse, the dromedary, rain-deer, &c.

tiply

tiply too fast for the safety of other animals, inciting the hunter by their precious skins, and by their mutual furiousness and continual war destroying one another. Again: Those remarkable for swiftness without strength^k, frequent thickets, holes, and wilds, where they may excite the pursuit, and promote the health and activity of the pursuer; even the most inconsiderable^l are intended to awaken our diligence, and teach us attention, neatness, and patience. Those which neither are game, nor docile and domestic^m, afford skins and furs for cloathing; what are bred to pastureⁿ, afford us food and cloathing, and labour too; every one, but in a different manner, supplies some want or conveniency of man, fashioned and formed thereto as servants trained up and determined to their respective occupations: but their faculties of mind are no less proportioned to this state of subjection, than the shape and properties of their bodies; they have knowledge peculiar to their several spheres, and sufficient for the under-part they are to act. If they had more or less, they would be of less or no service to man; they have instinct to feed themselves, to continue their *species*, to facilitate and reconcile themselves to their labour and rest, to apply their strength and agility, and this is enough; if they had reason, if they had a higher degree of knowledge, and could compare their ideas, select and resume by memory, and make deductions from what is past, as well as foresee and anticipate what is to follow, they would be the plagues of mankind; they would repine, resent, reveal, combine, rebell, and neither their strength nor swiftness, neither their flesh for food, nor their skins and fleeces for cloathing, would be at our disposal; their bodily powers enabling them to be masters, they would no longer endure their present necessary and much happier state of subordination.

From brutes therefore, we are directly lead to their lord and master, Man.

C H A P. XXVI.

Of the Inhabitants; their Number, usual Age, Customs, Pastimes, Festivals, Manners good and bad, Language, Tenures, Arts.

ALTHOUGH the eastern part of this county may not exceed any ordinary equal space in other counties solely addicted to husbandry, in the number of inhabitants, yet the western half, where there is tin and fish, is extremely populous, and may

^k Hare, rabbit, fox, &c.

^m Beavers, sable, ermins, &c.

^l As rats, mice, moles, vermin, and insects.

ⁿ Sheep, goats, bullocks, &c.

vie in that respect with any part of England of the same dimensions, where there is no great town or city.

SECT. I. The inhabitants are usually of middle stature, healthy, strong, and active, mining and fishing enabling them to bear watching, cold, and wet, much better than where there are no such occupations : the miners particularly, who escape accidents, and live temperately, generally live to a great age ; the alternate daily use of cold and heat, wet and dry, hardening their bodies equally against the different extremes of weather.

SECT. II. Our air, it must be allowed, is very salt, and its influences upon tender, squalid, and neglected habits, proportionably fretting and acrimonious ; but to the natives in general it cannot be said to be unhealthy, as many instances of long-life occurring in Cornwall perhaps, as in any part of Britain. Mr. Carew (who lived in the reign of Eliz.) observes *, that eighty and ninety years of age was ordinary in every place ; and among other instances of longevity, names one Polzew, who died a little while before his writing, aged one hundred and thirty years. Mr. Scawen, a gentleman of no less veracity, in his MS° tells us, that in the year 1676, died a woman in the parish of Gwythien (the narrowest, and therefore, as to the air, to be reckoned among the saltiest parts of this county) one hundred and sixty-four years old, of good memory, and healthful at that age ; and at the Lizherd, where (exposed as this promontory is to more sea on the east, west, and south, than any part of Britain) the air must be as salt as any where, there are three late instances of people living to a great age : The first is Mr. Cole, late minister of Landawidnek, (in which parish the Lizherd is) who by the parish register, A. D. 1683, appears to have been above one hundred and twenty years old ^p when he died ^q. Michael George, late sexton of the same parish, buried the twentieth of March, ibid. was more than a hundred years old ; and being at the Lizherd with the Rev^d. and worthy Dr. Lyttelton, Dean of Exeter, in the year 1752, we went to see a venerable old man called Collins ; he was then one hundred and five years old, of a florid countenance, stood near his door leaning on his staff, talked sensibly, was weary of life he said, and advised us never to wish for old-age. He died in the year 1754.

* Page 61.

o Pen. Car. Lyttelton, L L. D. Dean of Exon.

p "Was aged above one hundred and twenty years by far." Regist. ibid.

q Of this Mr. Thomas Cole, I find the following memorandum written in my Hakewells Apology, page 166, signed J. M. (viz. James

Millet, late Vicar of St. Just) : "Thomas Cole, Minister of and at the Lizard, went one morn on foot from Lizard to Penryn, whitch is at least thirteen miles, and returned again the same day on foote to Liz^d, at which time he was at least one hundred and twenty years, and was met going and coming by Mr. Richard Erisey of Erisey, as credible authors report."

Some instances of the strength, and activity of body among the SECT. III. Cornish, Mr. Carew has given us (page 63), to which I refer; but one instance of the strength of the human *thorax* I have met with, too remarkable to be passed by in silence: Tuesday, March 22, 1757, between twelve at noon and one o'clock, John Chilew of the parish of Ludgvan, carrier, aged forty-one years, walking by the side of his wain, by accident fell on his back in the way of the wheel, and before he could extricate himself, the wheel took on upon his left shoulder, broke his collar-bone, and went off just below his right arm-hole: the wheels were about three inches and a half wide, shod with iron plates, and nails proportionably. The whole weight of the wain may be moderately computed at six hundred pounds weight: in the wain were four blocks of tin of three hundred and ten pounds each, a cask of brandy two hundred and fifty pounds, some baskets with trifling weights reckon twenty pounds: the floor of the road on which he lay was level, so that his breast had the full pressure of one half at least of two thousand one hundred and ten pounds during the passage of the wheel. On Friday, April 1, he was well enough to come on foot to church half a mile from his own house, complained only of his breast being sore, which he attributed to the buttons of his coat being pressed inward by the run of the wheel: he has followed his calling ever since in the same manner as he did before, without any inconveniency.

Nature is strong, and more perfectly compacted in some subjects SECT. IV. than in others; but it is rare that she is at all defective in any: Defective birth. some instances however there are, in which the human frame is but half formed, and that distorted. "On the first of June, A. D. 1634, the wife of one Richard Lower, dwelling at Hunt's-barne within the parish of St. German's, was in the night delivered of a double birth; the one a perfect male child, the other seemed to be of the same form and sex, wanting a head, but the neck thereof seemed to advance itself somewhat above the shoulders, on the left side whereof there grew a lock of hair of somewhat less than an inch in length; the upper part of the neck seemed raw and bloody, but overgrown with a perfect skin: it likewise wanted the left arm (without any break of the skin), and the thumb and little finger of the right hand; the navel stood in the midst of the breast, where all the bowels lay, yet the belly thereof perfect; the feet had the heels turning forwards, and the toes backward, and the legs lying acros, of which the right had three, the left but two, and those conjoined together with a third; nails likewise thereon that grew out of the flesh *."

* From a M S of the late learned John Anstis, Esq; Garter King at Arms, communicated by the Rev^d. Dr. Milles, Praeceptor of Exeter.

SECT. V. The powers of the mind, together with the nervous faculties of the body, are sometimes interrupted and suspended, and then restored: the most remarkable instance of which happened lately in the town of Penzance to Phillis wife of Thomas Sibley, fisherman, who on the third of August 1744, aged then about forty-one years, had a male child, was well in health, nursed the child, and had plenty of milk; but within a few weeks after (*viz.* in September 1744) upon hearing a rumour that her husband was drowned in Gwava-s-lake by the then violent storm, took fright; this struck back her milk immediately, she grew low-spirited, gradually weaker, despaired of remedy, lost her memory (but not totally), and scarcely distinguished one person or thing from another: On the seventh of May, 1747, she had a dead child, but was so weak that she was not sensible of her having had a child; and about six weeks after being brought to-bed, lost her memory quite, knew no one, and lost her mouth speech. She used at times milk, broth, fish, and potatoes, as they were administered, but could make no stir to feed herself; and in the whole taking little nourishment of any kind, was altogether emaciated, and continued without motion, speech, and apprehension, till Christmas 1753, when, on a Sunday night, she had several strong convulsive fits, and the family thought these her last struggles; but they were only the efforts of Nature to remove obstructions, and restore the sensibility of the nervous system. The fits returned the next day, and when they had ceased, she seemed to take a little more notice of things round her than she had done before; then perceptibly bettered in senses and discernment for about half a year, when, a little before Midsummer 1754, after much struggling, she spoke a few words very imperfectly and like a child learning to pronounce, found her tongue very stiff, and was some days before she could speak distinctly, after being seven years and two weeks utterly speechless. She has the character of a serious, good woman; and when I saw her, July 27, 1757, inclined to be corpulent.

SECT. VI. Among ancient customs still retained by the Cornish, may be reckoned that of decking their doors and porches on the first of May with green boughs of sycamore and hawthorn, and of planting trees, or rather stumps of trees, before their houses. From towns they make excursions on May eve into the country, cut down a tall elm, bring it into town with rejoicings, and having fitted a straight taper pole to the end of it, and painted it, erect it in the most publick part, and upon holidays and festivals dress it with garlands of flowers, or ensigns and streamers. Keyser¹ thinks that

¹ Page 88 of Northern Antiquities.

" this

" this custom took its rise from the earnest desire of the people to see their king, who seldom appearing at other times, made his procession at this time of the year to the great assembly of the states held in the open air ; the women and men therefore, drawn by curiosity, passed their nights and days, but especially the night before the first of May, (allured by the vernal season) in dancing and feasts in the open air and in the woods," in memory of which rural nocturnal assemblies, early on the first of May every house has its bough or branch at the door, as if the master was but just returned from the woods. This is not improbable, but it is as likely that this custom is nothing more than a gratulation of the spring, and had no other foundation than to display the leaves and blossoms which begin at this time to adorn every hedge, tree, and shrub ; of this every house was to take notice, and by exhibiting a proper signal of the spring's approach, to testify their universal joy at the revival of vegetation.

It is a general custom in Cornwall to make bonfires in every village on the eve of St. John Baptist's and St. Peter's day, which I Bonfires.
have in another place expatiated upon^m, as the remains of part of the Druid superstition.

Another general custom was the *PLAY* or interlude in the Cornish tongue. Of these plays the subjects were taken from Scripture, and the design suitably good, even that of instructing the common people in the meaning and excellency of the Holy Scripturesⁿ, although the design, it must be owned, is executed in a coarse and rude manner.

" There are two MSS in the Bodleian Library which contain some interludes, or, as the author calls them, *Ordinalia* : the first in parchment, written in the fifteenth century, exhibits three *Ordinalia* ; the first treats of the creation of the world, the second of the passion of our Lord Jesus Christ, the third of the resurrection^p. The other MS is on paper, written by William Jordan, An. 1611. This has only one *ordinale*, of the creation of the world and the deluge^q. There is a third book written in Cornish on vellum, which Mr. Ed. Lhuyd (late keeper of the Musæum at Oxford) received from John Anstis, Esq; Garter King at Arms before mentioned.

^m Antiquities of Cornwall, page 130, 131.

ⁿ Bishop Nicholson's Letter to Dr. Charlett, November 14, A.D. 1700 ; of which see Antiquities of Cornwall, page 196.

^o Mr. Lhuyd's account of them in a letter to Thomas Tonkin, Esq; 1707 ----MS Tonkin, page 36.

^p Bib. Bodl. B. 40, Art. given by James Button, Esq; of Worcestershire, An. 1615.

^q Mr. Hals in his MS (viz. Descr^a. of Cornwall) says, that these plays in MS were brought into Oxford A.D. 1450 ; but this must be a mistake (if he means all), the last-mentioned being not written till the beginning of the last century.

It treats of the *PASSION* in metre, but not in dramatick dialogue, entitled Mount Calvary.

The first *ordinale* of the creation begins thus (God the Father speaking) :

Cornish.	Englighed.
En Tas a Nef ym Gylmyr	The Father of Heaven I the Maker,
Formyer pub tra a vydh gwrys	Former of every thing that shall be made,
Onan ha tryon yn gwyr	One, and Three, truly,
En Tas, han Mab, han Spyrys.	The Father, the Son, and the Spirit,
Ha hethyn me a thesyr	Yes—this day it is my will
Dre ou grath dalleth an Bys	Of my especial favour to begin the world.
Y lavaraf, nef, ha Tyr	I have said it—Heaven and Earth
Formyys orthe ou brys.	Be ye formed by my counsel.

This metre is not ill chosen or unmusical.

The scanning to be performed in the following manner :

Eñ Tăs-ā Nĕf-ŷm Gŷl-wŷr
Fōrmŷ-ēr pūb-trā vŷth-gwrȳs, &c.

It is the Trochaic Heptasyllable, otherwise called the Trochaic Diameter Catalectic¹. It consists of three trochees and a semiped. Aristophanes was very fond of it at times².

In Latin, Horace adopts it,

Nōn ēbūr nēque aūrēūm.

In English, Shakespeare frequently uses it ; and Dryden for his tenderest numbers :

Softly sweet in Lydian measure,
Soon he sooth'd his soul to pleasure.

The language suits the metre ; as the subject is sublime, the composition is not unsuitable, as may be seen by the above and following stanza :

Yn peswere gwreys perfyth
Then bys ol golowys glan,
Haga hynwyn y a vyth
An Houl, an Lor, h'an Steryan.
Me a fet a Hugh an gueyth
Yn creys an Ebron avan,
An Lor yn nos, Houl yn geyth
May rollons y golow Splan.

In the fourth [day] I shall make perfect
For the world all the resplendent lights,
And I will that they be called
The Sun, the Moon, and the Stars.
Them will I place on high
In the midst of the firmament above,
That the Moon by night, the Sun by day,
May yield their glowing splendour.

The stanza consists of eight verses with alternate rhymes ; sometimes this is changed for a stanza of six, of which the first and second are of one rhyme, the fourth and fifth of another, and the third and sixth line of a third rhyme ; but the heptasyllable metre continues throughout with few deviations in this piece and all the others.

¹ Mr. Scawen had a copy of this book in 1678, long before Mr. Ed. Lhuyd had his copy from Mr. Anftis, and gives a literal translation of it. The MS has been mentioned before, and is in the pos-

session of the Reverend Dr. Lyttelton, Dean of Exeter.

² Upton on Shakespeare, book III.

³ Ibid.

The poetry is the least exceptionable part of these interludes: A Drama. person called the *Ordinary* was the chief-manager; every thing was done as he prescribed, and spoken as he prompted^u. The persons of the drama are numerous, in this no less than fifty-six in number; in the 2d, 62; in the 3d, 60; Princes, Patriarchs, Saints, Angels, (good and bad) and even the persons of the ever-blessed Trinity are introduced. Unity of time, action, and place, is not at all attended to; this first-mentioned play runs through a space of time from the creation to King Solomon's building the Temple, and incongruously ordaining a Bishop to keep it^v. It takes in also the fabulous legend of the Martyrdom of Maximilla, in which part the actors are a Bishop, a Crosier-bearer, a Messenger, four Tormentors, the Martyr, Gebal, and Amalek. The Bishop gives to the tormentors for putting the Martyr to death, Behethlan, Bosaneth, and all Chenary^x. King Solomon speaks the Epilogue; the audience, with a strict charge to appear early on the morrow in order to see the *PASSION* acted, is dismissed in these words:

Cornish.

Abarth an Tas,
Menstroles a' ras
Pebourgh whare,
Hag ens pub dre.

Englised.

In the name of the Father,
Ye Minstrels holy,
Tune your pipes,
And let every one go to his home.

This may serve to give a general notion of these interludes, which were all translated into English by the late Mr. John Keigwyn of Mousehole, at the desire of the late Right Reverend Sir Jonathan Trelawney, Baronet, Bishop of Winchester, in a literal manner, for the better understanding the language, tho' to the disadvantage of the Poet, and his language too. The best composition now extant in the Cornish tongue, is that called Mount Calvary, which is not dramatic, but narrative, and more solemn; the incidents (with few exceptions) are all taken from the Gospel History of the Passion, and the circumstances of distress and suffering very affecting. It was first turned into metre (as I imagine^y) by the before-mentioned Mr. Keigwyn at the instance of Mr. Scawen of Molinek before-mentioned; but Mr. Scawen disliking that translation, has placed a literal one in the Lyttelton copy. But to return to the interludes: The places where they were acted were the *Rounds*, a kind of amphitheater, with benches either of stone or turf. Of the former sort that exhibited in the Antiquities of Cornwall (page 196, Plate xvi. Fig. 1.) served this purpose; but a much larger one, of higher

^u Car. page 72.

^w The wages he gives to the mechanics for their labour is all the field of Behethlen, all Penrynn-wood, Enys, and Arwinek, Tregeuler,

and Kegyllek.

^x Places in Cornwall.

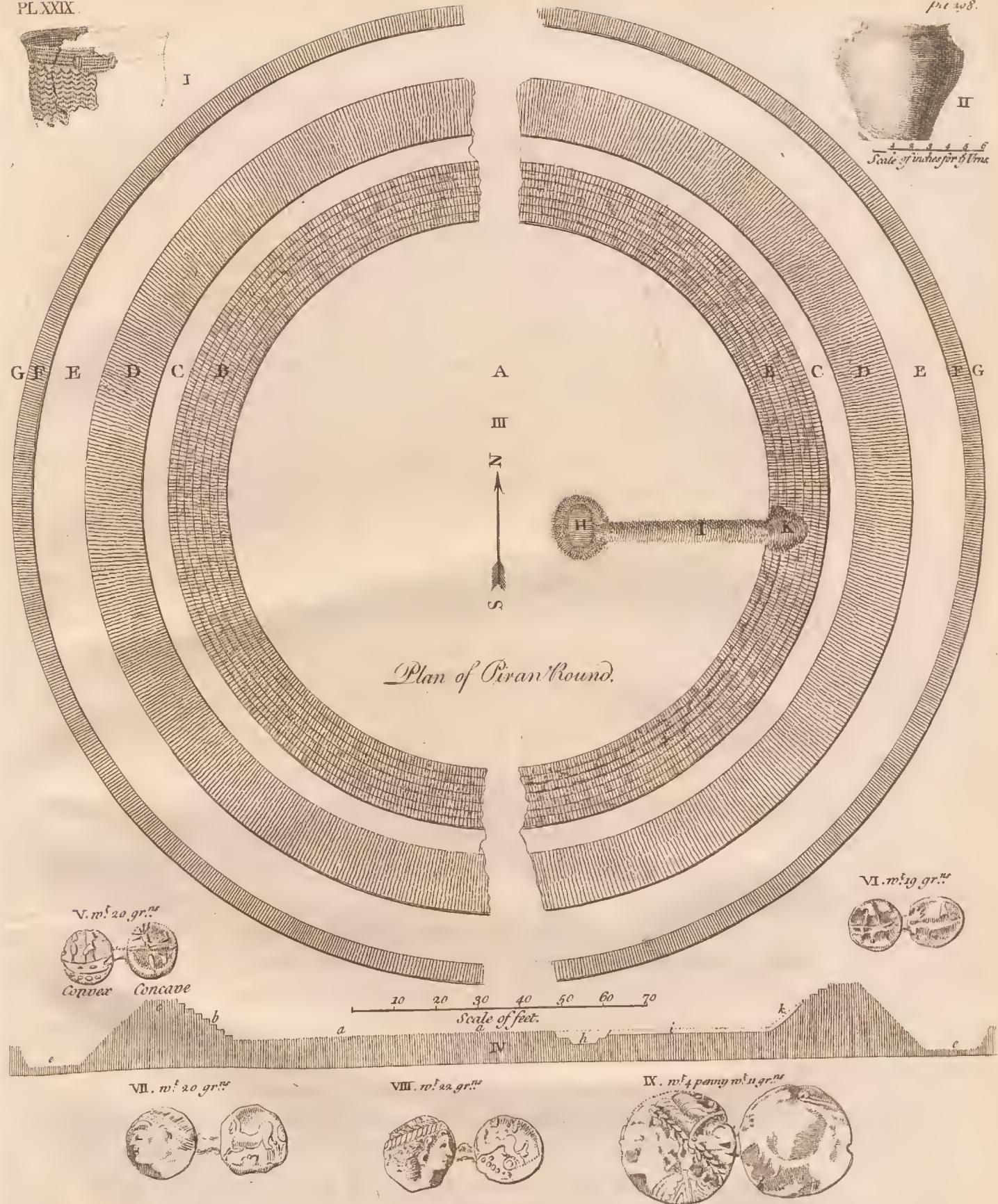
^y See Scawen's own account in Tonkin's M S., page 96.

mound, fosset on the outside, and very regular is the amphitheater in the parish of Piran-sand, which, as it has some peculiarities, I have here planned, Pl. xxix. Fig. III. with the following references:

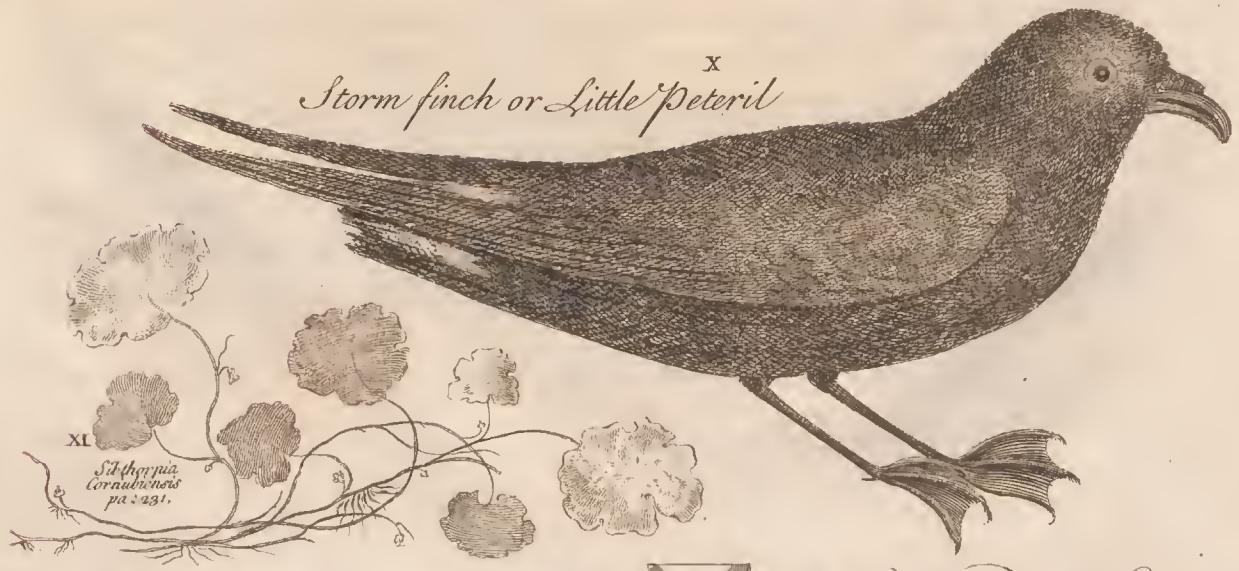
Piran-round. A, the area of the amphitheater, perfectly level, about one hundred and thirty feet diameter; B, the benches, seven in number of turf, rising eight feet from the area; C, the top of the rampart, seven feet wide; D, the outer slope of the rampart; E, the foss; F, the slope of the foss; G, the level of the hill on which the work is formed; H, a circular pit, in diameter thirteen feet, deep three feet, the sides sloping, and half way down a bench of turf, so formed as to reduce the area of the bottom to an ellipsis; I, a shallow trench, running from the pit H nearly east, four feet six inches wide, and one foot deep, till it reaches the undermost bench of the amphitheater A, where it is terminated by a semi-oval cavity K, eleven feet from north to south, and nine feet from east to west, which makes a breach in the benches.

Fig. iv. shews the profile of the whole work; *a*, the area; *b*, benches; *c*, rampart; *e*, the foss; *b*, the pit; *i*, the trench; *k*, the cavity.

This is a curious and regular work, and is formed with the exactness of a fortification, but the visible benches within, the pit, the trench, and cavity, and the foss having no esplanade beyond it, determine it in its present figure to the uses of an amphitheater. The greatest difficulty is to account for the pit H, and the trench and cavity I K, which are appendixes to it. Now it must be observed, that the scenery part of these performances was much worse than the composition; that the subject being taken from Scripture-History, the persons of the Deity brought upon the stage from above, and the infernal spirits from below, they thought it necessary to appropriate peculiar places to actors of such different characters; accordingly I find by their interludes that they had a place in their *Rounds* which they called Heaven, and I infer from thence that they had another called Hell; and from these two places the different beings were to proceed when they came to act, and withdraw to, when their parts were finished: I conjecture therefore, that as K might represent the upper regions, so the pit H might be allotted to the infernal. In the interlude of the resurrection also, the pit H might serve for the grave; the trench, and the cavity might be designed to exhibit the ascension into Heaven. How proper these wild expedients were to raise the admiration, affections, and piety of the beholders, the judicious reader will easily guess, and lament the age of ignorance, when by mutual consent of Laity and Clergy, (for without both they could not take place) the people were to have every truth set before their eyes by memorials,



X
Storm finch or Little Peteril



To Christopher Hawkins Esq.
of Trevenard in Cornwall Esq.
this Plate of Antiquities, the Peteril &c.
is with great respect inscribed by
W. Borlase.

rials, scenes, and symbols, though the most incoherent, unedifying, and absurd.

These interludes obtained not only in Cornwall (where they were called *Guare-mir*, or Miracle Plays, and the place of acting *plaen an guare* *), but elsewhere, and lasted sometimes more than one day, and were attended not only by the vulgar, but by people of the highest condition, and were remembered, says Bishop Nicholson ², by the last generation. In the late edition of Stow's Survey, vol. I. page 247, is the following account : " But London for the shows upon theatres and comical pastimes, hath holy plays, representations of miracles which holy confessors have wrought, or representations of torments wherein the constancy of martyrs appeared." And again : " These or the like exercises have been continued till our time, namely, in stage-plays, whereof we may read in the year 1394 (seventeenth of Richard II.) a play to be played by the parish clerks of London at the Skinner's-Well, besides Smith-Field, which play continued three days together, the King, Queen, and Nobles of the Realm being present ; and of another played in the year 1409, (tenth of Henry IV.) which lasted eight days, and was of matter from the Creation of the world, wherat was present most part of the Nobility and Gentry of England ³." Some faint remains of the same custom I have often seen in the west of Cornwall during the Christmas season, when at the family-feasts of gentlemen, the *Christmas Plays* were admitted, and some of the most learned among the vulgar (after leave obtained) entered in disguise, and before the gentry, who were properly seated, personated characters, and carryed on miserable dialogues on Scripture-subjects ; when their memory could go no farther, they filled up the rest of the entertainment with more puerile representations, the combats of puppets, the final victory of the hero of the drama, and death of his antagonist.

Among the general customs, we must not forget the manly exercises of wrestling and hurling, the former more generally practised in this county than in any part of England, the latter peculiar to it. The Cornish have been remarkable for their expertness in Athletary contentions for many ages, as if they inherited the skill and strength of their fabulous first Duke Corinæus, whose fame consists chiefly in the reputation he won by wrestling with, and overcoming the giant Gogmagog, and that fable perhaps founded five hundred years since upon the then acknowledged and universal reputation of the people of this county for wrestling. But to leave fables ; what should have implanted this custom in such a corner of

* That is, the plain for plays.

² Letter, ib. ut supra.

³ From Fitz Stephen.

Britain, and preserved it hitherto in its full vigour, when either never affected at all, or with indifference in other parts of the island, we cannot say; certain it is the Grecians, who traded hither for tin, and hither only, had the highest esteem for this exercise. The arts of the *Palæstra* were chiefly cultivated by the Lacedemonians, and yet Plato himself among the Athenians was so far from disapproving the exercise, that he recommends it to the practise of old as well as young women, and thinks it proper for them oftentimes to wrestle with men, that thereby they might become more patient of labour, and learn to struggle with the difficulties incident to a warlike state. The ardour for this exercise so prevailed at last, that all Greece devoted their time and inclinations to the *Gymnasia* and *Palæstra*, and chose rather to be accounted the most expert wrestlers, than to be celebrated as the most knowing and valiant commanders^b. Whether the Cornish borrowed this custom from the Grecians, or whatever else was the cause, you shall hardly anywhere (as Mr. Carew observes, page 76) meet with a party of boys who will not readily entertain you with a specimen of their skill in this profession.

SECT. X. Hurling is a trial of skill and activity between two parties of twenty, forty, or any indeterminate number; sometimes betwixt two or more parishes, but more usually, and indeed practised in a more friendly manner, betwixt those of the same parish; for the better understanding which distinction, it must be premised, that betwixt those of the same parish there is a natural connexion supposed, from which (*ceteris paribus*) no one member can depart without forfeiting all esteem. As this unites the inhabitants of a parish, each parish looks upon itself as obliged to contend for its own fame, and oppose the pretensions, and superiority of its neighbours.

It is so termed from throwing or *hurling* a ball, which is a round piece of timber, (about three inches diameter) covered with plated silver, sometimes gilt. It has usually a motto in the Cornish tongue alluding to the pastime, as *Guare wheag, yw Guare teag*, that is, fair play is good play. Upon catching this ball dexterously when it is *dealt*, and carrying it off expeditiously notwithstanding all the opposition of the adverse party, success depends. This exercise requires force and nimbleness of hand, a quick eye, swiftness of foot, skill in wrestling, strength and breath to persevere in running, address to deceive and evade the enemy, and judgment to deliver the ball into proper hands, as occasion shall offer: in short, a pastime that kindles emulation in the youngest breast, and like this requires so general

^b Alex. ab Alexandro, lib. II. vol. I. page 494.

an exertion of all the faculties of the body, cannot but be of great use to supple, strengthen, and particularly tend to prepare it for all the exercises of the camp.

These two customs of wrestling and hurling were formerly much more used than at present, and 'tis great pity that frolicking and drinking immoderately (if what is said be true) at the parish festivals should take place of such ancient, and (under a few regulations) such laudable and manly recreations. The particular rules and customs by which these two pastimes are directed, and the different manners in which they are practised, cannot be more distinctly related than the reader (who desires to be acquainted with them more minutely) will find in Mr. Carew's Survey of Cornwall (Edit. 1. page 74). There is no stated time for hurlings and wrestlings, but they are generally part of their festival entertainments. Every parish has its annual feast, and at such time (however poor at other times of the year) every one will make a shift to entertain his friends and relations on the Sunday; on the Monday and Tuesday all business is suspended, and the young men assemble and hurl or wrestle, or both, in some part of their parish of the most public resort.

These feasts instituted in memory of the dedication of their SECT. XI.
parochial Church, were of great esteem among the primitive Parish feasts. Christians, and originally kept on that Saint's day to whose memory the Church was dedicated: the munificence of the founder, and endower of the church, was at the same time celebrated, and a particular service composed for the occasion^c. On the eve of that day there were prayers all night in the Church, and hymns sung in memory of the Saint, and the dedication made to him. From these watchings, the festivals were called Wakes, and the name still continues in many parts of England, though the custom whence it arose has been long abolished. The inconvenience of observing these festivals on the Saint's day being sensibly felt (especially in harvest time), they were by the special authority of the Bishop transferred to the next following Sunday, and this innovation occasioned the injunction of the twenty-eighth of Henry VIII. that the feast of the dedication of churches should be celebrated in all places of this realm on the first Sunday in October for ever, and upon no other day. This injunction was complied with in some places, but never universally admitted, custom in this case prevailing against Law. These feasts are much exclaimed against by those who distinguish not, as they ought, between the institution,

^c See Durandus *Rationale Divin.* lib. vii. fol. 251, and Dugdale's *Warwickshire*.

and the degenerate disorderly observation of it, “ and the judges of the assize, *Walter* and *Denham*, made an order at Exeter, A. D. 1627, to suppress all such feasts: the same was done in Somersetshire A. D. 1631; but upon Bishop Laud’s complaint, says my author^a, the last order was reversed; the Lord Bishop of that diocese^c, with seventy-two of the most orthodox and able of his Clergy, having certified under their hands, that on these feast days, which generally fell on Sundays, the service of God was more solemnly performed, and the Church much better frequented, both in the forenoon and afternoon, than on any other Sunday in the year; that the people very much desired the continuance of them, and that the Ministers did in most places do the like for these reasons, *viz.* for preserving the memorial of the dedication of their several Churches, for civilizing the people, for composing differences by the mediation and meeting of friends, for increase of love and unity by these feasts of charity, and for the relief and comfort of the poor.”

The tanners hold some holidays peculiar to themselves, particularly the Thursday, one clear week before Christmas-day, which they call *Jeu-whydñ*, or White Thursday, in commemoration (as constant tradition says) of black tin being first melted in these parts and turned into white tin, it being the custom anciently, as it seems, to export into other parts the tin-ore unmelted, or carry it to the engroffer’s melting-house however distant.

The tanners also hold St. Piran’s day on the fifth of March, cease from all labour, and (in all considerable mines) are allowed money to make merry withal in honour of St. Piran, who is recorded to have given them some very profitable informations relating to the tin-manufacture.

SECT. XII. A very singular manner of curing madness is that mentioned by Mr. Carew (page 123) in the parish of Altarnun in this county.
 Local cus-
 toms. Bouffening. It was the custom to place the disordered in mind on the brink of a square pool, filled with water which came from St. Nun’s well^f. The patient having no intimation of what was intended, was, by a sudden blow in the breast, tumbled into the pool, where he was tossed up and down by some persons of superior strength, till being quite debilitated, his fury forsook him; he was then carried to the Church, and certain masses sung over him; if he was not cured at once, the immersion was repeated. This custom was practised probably in some other parts of this county as well as at Altarnun; for at the foot of St. Agnes’s holy well (a place formerly of great resort) I

^a Dugdale’s Warwickshire, last Edition, page 682.

^c Bath and Wells.

^f Nun or Nunne being the patroness Saint, from whose altar (famous I conjecture for some miracles) this parish had its name.

think

think the remains of such a pool are still to be discovered, though the sea has demolished the walls. The Cornish call this immersion, *Bouffening*, from *Beuzi* or *Bidhyzi*, in the Cornu-british and Armorick, signifying to dip, or drown. *Belgicè Buysen* (says Lye's Junius in *Bowse*) *unde Anglicè Bowse potare, largiter bibere.* This may seem to the generality so very impotent a remedy, that people might easily be persuaded to look upon any cure that ensued as the miraculous effect of the holy water, and the interposition of St. Nun; but if we recollect that madness is no other than a raging fever that interrupts for a while, and dissipates all congruity betwixt ideas and things, we may soon satisfy ourselves, that without any miracle, so violent an exercise of the body in cold water was no contemptible prescription, something very like this method in parallel cases having been approved of and practised by the greatest physicians^s.

Among the punishments inflicted in Cornwall of old time was *Cocking-stool*.^t that of the cocking-stool^b, a seat of infamy where strumpets and scolds, with bare foot and head, were condemned to abide the derision of those that passed by, for such time as the bailiffs of manors, which had the privilege of such jurisdiction, did appoint. "This jurisdiction was granted, says Halsⁱ, [or rather at an inquisition declared to belong] to the manor of Cotford Farlo, in the parish of St. Wenn, Cornwall, in those words, lately to be seen in the records of the Exchequer: "Maner. de Cotford-farlo, alias Lancorla in St. Wenn-moor, temp. Hen. 3. Quia per objurgatrices et meretrices multa mala in Manerio oriuntur, lites, pugne, diffamaciones et alie multe inquietationes per earum putefias^k; igitur utimur de eisdem quod cum capte fuerint, habeant judicium de Cocking-stool, et ibi stabunt nudis pedibus, et suis crinibus pendentibus dispersis tanto tempore ut aspici possint ab omnibus per viam transeuntibus secundum voluntatem Balivorum nostrorum capitalium."

An ancient annual procession there was formerly at Lostwythel ^{A procession} which retained some traces of the royalties anciently belonging to the little kingdom of Cornwall: It was but of late years discontinued, says Mr. Carew, (page 138) who there gives us the following account of it: "Upon Little Easter Sunday, the freeholders of the town and manor did there assemble, amongst whom one (as it fell to his lot by turn) bravely apparelled, gallantly mounted, with a crown on his head, a scepter in his hand, a sword born before him, and dutifully attended by all the rest also on horseback, rode thro' the principal street to the Church; there the Curate in his best

^s See Sir J. Floyer of cold bathing.

^b Reëtius f. Coquine, anciently cockaigne, signifying an idle jade, a base woman. Hickes in Jun.

ⁱ M S History of Cornwall.

^k That is, *Putagia*, acts of fornication, Spelm. Glossar.

beseene solemnly received him at the Church-yard style, and conducted him to hear Divine Service, after which he repaired with the same pomp to a house fore-provided for that purpose, made a feast to his attendance, kept the table's end himself, and was served with kneeling, assay, and all other rites due to the estate of a Prince : with dinner the ceremony ended, and every man returned home again. The cause and author out-reach remembrance howbeit these circumstances offer a conjecture that it shoulde betoken the royalties appertaining to the honour of Cornwall."

SECT. XIII. As to the manners of the inhabitants, they are generally allowed
Manners. to be civilized and courteous to strangers, and this is no novel character, but stands recorded as anciently as the times of Augustus Cæsar, and is attributed by Diod. Siculus¹ to that frequent intercourse with merchants of foreign countries, which the traffic for their tin could not but occasion. Τῆς γὰρ Βρετανικῆς καλὰ τὸ ἀκρωτήριον τὸ καλύμενον Βελέριον οἱ καλοκανθεῖς φιλόξενοί τε διαφερόντως εἰσι, καὶ διὰ τὴν τῶν ξένων εμπόρων ἐπιμιξίαν ἐξημερώμενοι τὰς αγωγάς. The gentry have the reputation of keeping up hospitality in their country, and though so remote from Court shewed formerly (and it is hoped do still shew) such an aptnes as well as capacity for the busines of the state, that Queen Elizabeth used to say, " that the Cornish gentlemen were all born courtiers with a becoming confidence^m."

Surrounded (almost) as they are by the sea, and reckoning themselves as it were of another and different nation from the English, in military expeditions they have generally kept themselves more unmixed from the rest of the army they roll with, than the inhabitants of other counties ; they therefore held some privileges peculiar to themselves. In Egbert's time they are said to have challenged the honour of leading the van in the day of battle, an honour which Michael Cornubiensis says, they enjoyed in the time of King Arthur. In Canute's reign, whether the danger was greater in the rear upon some remarkable retreat of his army, or whether the Dane piqued himself upon inverting all the Saxon order of battle, we find the Cornish brought up the rear, which by Joh'. Sarisburiensis is attributed to their distinguished valourⁿ. Humphry Lhuyd in his breviary (page 3) calls them the stoutest of all British nations, and says they were accounted to that time (1568) the most valiant in warlike affairs.

The usual exercises of hurling and wrestling which prevailed formerly (and even in the remembrance of the present age) not only among the vulgar, but among the gentry also, who promoted those trials of strength and agility, headed their several parties, dealt the

¹ Lib. iv. page 301, Edit. Hanov. 1604.

page 469.

^m See Floyd's Memoirs of the Civil Wars,

ⁿ Carew, page 83.

ball,

ball, and rewarded the victors) contributed surely from all antiquity to make them active, and boldly face their adversaries; moreover the occupation of miners hardens the constitution (as has been observed before), and renders it more patient of those excesses to which the life of a soldier is so frequently exposed; these perhaps were the reasons why the Cornish gentlemen and their forces, as well without, as within their own county, won immortal honour by their behaviour in the civil wars during the reign of Charles the first: of their bravery and loyalty that King was equally sensible, and distinguished them from the rest of his subjects by the following letter, which he ordered to be read and preserved in every Church and Chapel throughout the County.

C. R.

To the Inhabitants of the County of Cornwall.

“ **W**E are so highly sensible of the extraordinary merit of our county of Cornwall, of their zeal for the defence of our person, and the just rights of our Crown, in a time when we could contribute so little to our own defence or to their assistance; in a time when not only no reward appeared, but great and probable dangers were threatened to obedience and loyalty; of their great and eminent courage and patience in their indefatigable prosecution of their great work against so potent an enemy, backed with so strong, rich, and populous cities, and so plentifully furnished and supplied with men, arms, money, ammunition, and provision of all kinds, and of the wonderful success with which it pleased Almighty God (though with the loss of some most eminent persons who shall never be forgotten by us) to reward their loyalty and patience by many strange victories over their and our enemies, in despite of all human probability, and all imaginable disadvantages, that as we cannot be forgetful of so great desert, so we cannot but desire to publish it to all the world, and perpetuate to all time the memory of their merits, and of our acceptance of the same; and to that end we do hereby render our royal thanks to that our County in the most publick and lasting manner we can devise, commanding copies hereof to be printed and published, and one of them to be read in every Church and Chapel therein, and to be kept for ever as a record in the same, that as long as the history of these times, and of this nation shall continue, the memory of how much that county hath merited from us, and our crown, may be derived with it to posterity.”

Given at our Camp at Sudely Castle,
the 10th of September, 1643.

The whole progress of the faithful Cornish in the King's Service may be seen in the Earl of Clarendon's History of the Great Rebellion, much to the credit of this county; but of all their actions, the battle at Lansdown near Bath does them most honour. Of their gallantry here Mr. Scawen^o, being himself a cavalier, produces not his own, but the evidence of their enemies, that is, of the Parliament-forces: "The enemy themselves have sufficiently given testimony thereto, looking upon it with admiration, acknowledging it such a service they never saw the like: Amongst others by Sir Ralph Knight, a Cromwellian, I have heard it magnified in more particulars than we ourselves could think fit to write." In memory of this battle^p, George late L^d. Lansdown erected a handsome monument on the field of action, on the north side of which is engraved the following description of Sir Bevil Granville, Baronet, of Stow in this county, general of the Cornish forces, who fell there:

" Conquest or death was all his thought, so fire
 Either o'ercomes or does itself expire.
 His courage work'd like flames, cast heat about,
 Here, there, on this, on that side none gave out,
 Nor any pike in that renowned stand
 But took new force from his inspiring hand;
 Soldier encouraged soldier, man urg'd man^q;
 And he urg'd all, so much example can;
 Hurt upon hurt, wound upon wound did call
 He was the mark, the butt, the aim of all;
 His soul this while retir'd from cell to cell,
 At last flew up from all, and then he fell.
 But the devoted stand enrag'd the more
 From that his fate, ply'd hotter than before,
 And proud to fall with him, sworn not to yield,
 Each fought an honour'd grave, and won the field:
 Thus he being fall'n, his action fought anew,
 And the dead conquer'd, whilst the living flew."

*Cartwright,
1643.*

" Thus slain thy valiant^r ancestor did lye,
 When his one bark^s a navy did defye,
 When now encompass'd round the victor stood,
 And bath'd his pinnace in his conquering blood,

^o M S, page 28.

^p Described particularly in Clarendon.

^q The poet had certainly in view the celebrated passage of Homer. Il. lib. XIII. v. 130.

Φεράξαντες δόρυν δέργη, σάκος σάκιον προθελύμαν
 Ασπίς αρέ ασπίδ' ἵριστη, κόρυς κόρυν, αἵρεα δ' ἀνίρη.

^r Hæret pede pes, densusque viro vir.

AEn. x. ver. 361.

^s Sir Richard Granville, Vice-admiral in the reign of Queen Elizabeth against the Spaniards.

^t The Revenge.

Till

Till all the purple current dry'd and spent,
He fell, and made the waves his monument.
Where shall the next fam'd Granville's ashes stand?
Thy Grandfire fills the sea, and thou the land.

Martin Lewellyn,
1643.

I make no apology for inserting these verses; it is sufficient that the noble founder of this monument, whose poetical abilities will not be disputed, chose to inscribe them on marble rather than any of his own composition.

To act impartially, I must turn the disagreeable side of my SECT. XIV. countrymen as well as the honourable to the reader, it being no Ill manners. more my design to conceal than to justify their failings. The lower sort of people is reckoned litigious^{*}; the truth is, that in mining as well as fishing there are very numerous and minute subdivisions of property, every working-tinner, though little or nothing worth, shall have oftentimes $\frac{1}{32}$ or $\frac{1}{64}$, and sometimes a less share of the adventure; these persons, if the adventure proves a losing one, as is frequently the case, prove the more unwilling the less they are able to pay the costs incurred. Again: Those little adventures do oftentimes shift hands, are bought and sold, and bought again: this produces wranglings, and frequent application to the law-courts. Again: The number of materials necessary to mining and fishing, is so great, that it entangles the people with a great diversity of sellers of ropes, candles, powder, iron, timber, salt, flax, hemp, line, and the mechanics who work them up; the more bargains the more disputes, some ill-designing persons being always ready to inflame and exaggerate rather than to appease the numerous dissensions to which such an intricate commerce is perpetually liable. A second reason of litigiousness in Cornwall, is, that we have as many sorts of law-courts here, as in any part of England. Besides the Courts of Assize and Ecclesiastical Courts, there is the Lord Warden's Court, from which there is a farther appeal to the Duke of Cornwall in Council; the Vice-Warden's Court held every month, and the Stannary-Courts held every three weeks for tin-causes. Here are also Court-leets of the Duke of Cornwall, and other Lords of Manors, for debts and disputes relating to property. By means of all these there is too open and easy access to law-contentions for the advantage of private families. Litigiousness is therefore partly the fault of the inhabitants, and in part the result of their polity and that multifarious trade to which their mining and fishery unavoidably exposes them; whereas in counties where husbandry is the chief or sole employ, business is in fewer hands, bargains plain and easily adjusted, and the gains not so great as to prompt those of a middle rank immediately to go to law.

Another and no inconsiderable corruption to which our inhabitants of the lower class are subject, may in part be attributed to the same cause (I mean their occupation), but can neither be justified by that, or any other plea; that is, spending much time and money in publick-houses, which defrauds the master of the labour he pays for, deprives the family of that subsistence which is their natural right; but above all, prompts the tipler to cheat and overcharge, not to say steal, in order to pay for the excesses he has been guilty of. If these extravagancies were only committed by those who had wherewithal to pay for them, the vice of excessive drinking would not be altogether so shameful; but the misfortune is, that the poorest working-tinner shall be credited by the ale-drawer till his account becomes considerable, then persecuted by bailiffs till he pays costs as well as scours. There is no part of England which has more reason to complain of this kind of debauchery than Cornwall, and I have heard it hinted, with some shew of reason, that since the present laws against drinking to excess are ineffectual, and the nature of a tinner's employ secretes him from his master's eye, 'tis great pity that some farther restraints should not be laid upon the keepers of publick-houses, and retailers of spirituous liquors, who might deservedly be restrained by law from suing any man, who had neither freehold or lease estate, for any sum exceeding one or two shillings, and not be at liberty even to sue for that but before a justice of the peace, or after the space of six months from the contraction of the debt. This would prevent the idle from spending what they have not; for if they had no credit, the ready-money they get comes in seldom, and must go in necessaries, and consequently would not be sufficient for the purposes of idleness. However that may be, this is certain, that to credit a poor labourer for superfluities, much more for excessive drinking, is to encourage and tempt him to neglect and transgress every serious duty of life.

Nor does this low luxury and great evil prevail only in the mining part of the county, but in towns and villages, which surely is to be attributed to the present too general (but it is to be hoped short-lived) corruption of our boroughs at the electing Members of Parliament. This fatal, infamous traffic begins with intemperance and riot; these dissipate every generous sentiment of freedom, love of our country, and inclination to industry: Venality naturally succeeds, and is followed by extravagance and idleness; these by poverty, and poverty (such is the round!) by abandoning themselves to intemperance again on the first opportunity, and repeating the basest prostitution of the highest privilege. A corruption this both of principle and practice, of patriotism and morality, infesting more counties than one; but so much the more to be lamented in

Cornwall,

Cornwall, as this County has so much a greater number of boroughs than any in Great Britain, and sends as many almost as the kingdom of Scotland itself ^w. However, the whole disgrace of this iniquity cannot rest upon my Countrymen. It is the much to be lamented vice of the nation, and not confined to the vulgar ; the part of the corrupted is indeed most shameful, (for so the world will have it) but that of the corrupter is at least equally guilty and ought to share our detestation.

And now I am engaged in this subject, it will not be foreign to SECT. XV.
the History of Cornwall, to enquire into the original of this so
much envied privilege, of sending a great number of representatives
to the House of Commons, from so small a county, and from bo-
roughs mostly so inconsiderable as to trade, inhabitants, and every
thing that can entitle places to distinction ; whilst several towns in
England, much superior in all respects ^x, have never been admitted
to the same honour.

This pre-eminence of our county is not ancient. From the 23d of Edward I. five boroughs only, (viz. Lanceston, Liskeard, Truro, Bodman, and Helston) sent two members each, and the county two. Lostwythel has held the same privilege from the 4th of Edward II. and sent two members once before, viz. in the 33d of Edward I^r. These are our only six ancient boroughs, and the num-
ber was neither diminished nor increased, till the 6th of Edward VI. excepting only in one instance, which shall be taken notice of in the sequel.

At this time (viz. in the latter end of the reign of Edward VI.) seven other boroughs, viz. *Saltash, Camelford, West-Loo, Granpont, Tindagel, Michel, and Newport*, were permitted to send up two members each.

In the first of Mary, *Penryn*, and in the fourth and fifth of the same reign, *St. Ives* had the like privilege.

In the first of Elizabeth *Tregeny* was admitted ; in the fifth *St. German's* and *St. Maw's*, in the 13th *East-Loo* and *Fawy*, and in the 27th of that reign *Callington*, making up the number of twenty one boroughs, which with the county return to parliament forty four members.

The reason of this modern addition to the boroughs of this county, may I think best appear from considering that the dutchy of Cornwall, (then in the crown and oftner so than separated from

^w Cornwall sends forty four members to parlia-
ment, and Scotland forty five.

Burton upon Trent, Leeds and others.

^x Sherborne, Manchester, Birmingham, Ely,

^y Not. Parliamentaria, by Dr. Willis, page
37, &c.

from it^z) yields in tin and lands an hereditary revenue, much superior to what the crown has in any county in England, and that eight of these boroughs^a had either an immediate or remote connection with the demesne lands of this dutchy, a link formerly of much stricter union and higher command than at present. Four other boroughs depended on, or wholly belonged to religious houses which fell to the crown at the dissolution of Monasteries, in the reign of Henry VIII. For instance, *Newport* rose with *Lanceston* priory^b, and with it fell to the crown. *Penryn* depended much on the rich college of *Glasney* and its lands; the manor also was alienated by Edward VI^c, but restored by Queen Mary, and the town privileged by her. *St. German's* was (after Bodman) the chief priory in Cornwall, and the borough of *Fawy* fell to the crown with the priory of *Tewardraith*, to which it belonged.

The other boroughs remain to be taken notice of. Michel belonged to the rich and highly allied family of the Arundels of Lanhearme, and St. Ives and Callington to the family of Pawlet (Marquis of Winchester, now Duke of Bolton) by marrying the heiress of Willughby Lord Brook, some time of Newton-ferrers in this county^d. Now these several connexions of the additional boroughs may point out to us the rise of this privilege.

Henry VII. reduced the power of the ancient Lords, and consequently advanced that of the Commons: Henry VIII. enriched many of the Commons with Church-lands; and in the latter end of the reign of Edward VI. the Duke of Northumberland could not but perceive of what consequence it was to his ambitious schemes to have a majority in the house of Commons; and Cornwall seems to have been pitched upon as the most proper scene for this stretch of the prerogative, because of the large property^e, and consequently influence of the Dutchy: Six towns therefore depending on the Dutchy and Church-lands, and one borough of a powerful family were indulged to send fourteen members. The ministry of those days were not so defective in artifice as not to oblige powerful Lords now and then with the same indulgence which they granted to these boroughs, thereby endeavouring either to reconcile them to their administration, or to make this guilty increase of the prerogative

^z Whenever the Sovereign has no eldest son, the Dutchy of Cornwall is in the Crown.

^a Saltash, Camelford, West-Loo, Granpont, Tindagel, Tregeny, St. Maws, and West-Loo.

^b The religious of St. Stephen's Collegiate Church being removed from the brow of the hill into a lower situation, contiguous to the walls of Lanceston, about three hundred years before, the town of Newport was built on the ground adjoining.

^c Not. *Parliamentaria*, vol. II. page 109.

^d Of which family one Lord was buried in the Church of Callington, where his tomb is still to be seen.

^e In the fifteenth of Henry VIII. the revenues of the Dutchy of Cornwall, with its dependant rights and manors, was reckoned, says Sir. J. Doderidge, at ten thousand and ninety-five pounds eleven shillings and nine pence, which property became greatly increased by the fall of religious houses in the end of the reign of Henry the eighth.

less invidious. Queen Mary in her short reign (probably from the same motives) admitted two more, and Queen Elizabeth, who never rejected any political precedent which might confirm her power, (though always, it must be owned, exerting that power for the prosperity of her people, as well as her own glory) admitted six other boroughs.

The only instances which could give the least colour of justice to these proceedings, were few, and weak. The borough of Tregeny sent burgesses, indeed twice, *viz.* in the twenty-third and thirty-fifth of Edward I. but no more till the first of Elizabeth. East-Loo and Fawy sent one and the same merchant, then called a Ship-owner, to a *council* at Westminster (not to Parliament) in the fourteenth of Edward III^f. Of these, however, Queen Elizabeth laid hold for the more specious promoting her designs: In her first year she revived the claims of Tregeny; in the fifth of her reign^g, "Burgesses being returned for St. Jermyne's and St. Maws in Cornwall, Mr. Speaker declared in the House, that the Lord Steward agreed they should resort unto the House, and with convenient speed to shew their Letters-Patents why they be returned in this Parliament:" "But they were no farther questioned (says Dr. Willis, ib. page 168), the Queen's inclinations being well understood."

In the thirteenth of Elizabeth both East-Loo and Fawy elected two members, which being taken notice of and examined into, "Report was made by the House of the validity of the Burgesses, and it was ordered by the Attorney-general's assent, that the Burgesses shall remain according to their returns; for that the validity of the charters is elsewhere to be examined, if cause be^h:" "By which means, says Dr. Willis, (ib. page 102) little or no dispute being made against the Queen's power, the house became greatly increased with representatives, especially by the sending of Burgesses from those boroughs."

Nor was it any objection, I imagine, to their sending up members, that these boroughs had little trade, few inhabitants, and those poor and of no eminence; these circumstances in all likelihood did rather promote than prevent their being privileged, as rendering them more tractable and dependant than if they had been large and opulent towns, inhabited by persons of trade, rank, and discernment.

It is true indeed, these places so summoned were old boroughs (in the legal acceptation of the word), that is, had immunities granted them by their Princes or Lords, exemptions from services in other

^f See the original writ, Pryn. Brev. Parliament. vol. IV. page 186, 187, where J. Shakelok was returned at the same time for Polruan only, and these Members allowed for forty-four days in going

to, staying, and returning from Westminster, four pounds twelve shillings.

^g Pryn. Brev. Parl. vol. IV. page 1178.

^h Pryn. Parl. Register, part IV. page 1179.

courts, privileges of exercising trades, of electing officers within their own district, and invested with the property of lands, mills, fairs, &c. paying annually a certain chief or fee-farm rent; most of them also were parts of the ancient demesnes of the Crown, and had been either in the Crown or in the Royal Blood from the Norman conquest¹, and by passing to and from the Crown often, and their privileges constantly reserved and confirmed at every transfer, these towns had acquired a kind of nominal dignity, but were in every other light inconsiderable, and no ways entitled to the power of sending members to Parliament, much less in preference to so many more populous communities in the other parts of England.

SECT. XVI. The chief trade in Cornwall consists in exporting tin, copper, and Trade. fish, and the principal imports are timber, iron, hemp, and such other necessaries as mining and fishing require. The Cornish had a privilege granted by Charles the first, for their steady attachment to the royal cause, of trading to all parts of the world^{*}; a privilege of more credit than profit, since trade has been fettered and so confined to exclusive companies; this however can be no excuse for that dangerous abuse of trade, called smuggling. The common people on the sea-coast are, it must be owned, too much addicted to carry off our bullion to France, and bring us back nothing but brandy, tea, and some other luxuries of life; nothing can be more pernicious to the interest of this county, as well as the kingdom in general, or to the constitutions of the inhabitants: the infection is spread below the rank of birth and fortune; there is not the poorest family in any parish which has not its tea, its snuff, and tobacco, and (when they have money or credit) brandy, and it is greatly to be feared that this destructive trade will not cease as long as the duties are so high, and consequently the profit of clandestinely importing foreign uncustomed goods so great and tempting.

SECT. XVII. The Cornish tenants usually chuse not to hold lands at a rack Cornish tenures and revenues. or yearly rent, but to pay a fine, and take lands of the Lord of the Soil, for the term of ninety-nine years determinable with the lives of three persons named in the grant or lease. This method of taking, they seem to have been inclined to, first, because their general turn being to mining, farmery is not so well understood here as in other parts; secondly, because the profits of mines and fishing come by starts, and after a lucky year, the owner not knowing well the management of cash, chuses to have some certain

¹ Once only excepted, when Pierce Gaveston was by the favour of Edward II. Earl of Cornwall

for a short time.

^{*} Camden, Annot. page 8.

income for it ; and least it should waste in an improper chanel, he deposits it with his landlord, and either takes a new lease or renews his old one ; thirdly, the numbers of people on the sea-coast, and in the tinning parts constantly increasing, occasion the dividing and splitting large tenements, equally to the advantage of the Lord, and the conveniency of his tenants, every one being willing to have a small share of house and land for his own life, and that of his nearest dependants in proportion to his ability. For a lease of three lives, the taker usually pays fourteen years value of the real annual profit of the estate, so that if the estate is worth ten pounds *per annum*, the tenant will not scruple to give one hundred and forty pounds fine, besides the conventional rent of one shilling *per pound*, *viz.* ten shillings reserved annually to the Lord ; but this usage admits of some abatements if in a neighbourhood thinly inhabited, and swells into a considerable increase, where the people are numerous, and trade and employ brisk ; so that in some tinn-parishes most tenements bring twenty years value for a lease of three lives, instead of fourteen. Other tenures there are, both of the Dutchy, Bishop's lands, and private Gentlemen's Manors, which are conformable to the particular customs of each manor, as in other parts of England. Of the Ecclesiastical revenues, I find the following calculation in Mr. Hals's MS ; but whether just or otherwise, I am not sufficiently informed to decide : " The yearly revenues of the parochial Churches of Cornwall, were computed (says Mr. Hals) by Edward Herle of Prideaux, Esq; in the year 1602, at sixteen thousand six hundred and twenty pounds ; the lay impropriations annually at eight thousand two hundred pounds. The Lord Bishop of this diocese is Lord of several manors and lands in Cornwall, worth annually, if they were not leased, twelve thousand pounds ; the lands which formerly belonged to religious houses, if not leased, are worth annually twenty thousand pounds. In this computation, chantries, oratories, and hospitals are not included."

The Cornish tongue is a dialect of that language which, till the E C T.
XVIII.
of the Cornish
language : its
idiom, proverbs,
declension, and
expiration.

Saxons came in, was common to all Britain, and more anciently to Ireland and Gaul ; but the inhabitants of this island being dispersed before those conquerors, and driven into Wales and Cornwall, and thence into Bretagne in France, the same language (as in like cases will always happen), for want of more frequent intercourse, became differently pronounced, spoke, and written, and in different degrees mixed with different languages : Hence came different dialects, one called the Welsh, the other the Cornish, the last the Armorick. The radicals are so much alike in all, that they are known and admitted by the inhabitants of either country ; but their

Grammar has so varied, that they cannot converse¹. The Cornish is reckoned more pleasing in sound because less guttural than the Welsh, and indeed than the other dialects. Thus, for instance, the Welsh say *Lech* or *Llech*, a flat stone, the Cornish, *Léb*. For *Lhwch*, (in Welsh a lake) the Cornish say *Lúb*, &c. "The Cornish, says Mr. Scawen, (M S, page 5) is not gutturally to be pronounced as the Welsh, nor mutteringly as the Armorick, nor whiningly as the Irish; ill qualities contracted by the two latter from their servitudes and much subjection, but the Cornish is manly and lively spoken, and like those other primitive tongues," viz. Celtic and Phenician. Again: "It is a tongue, as used in Cornwall, most like the Phenician," ibid^m. and this intermixture of the Punic is the reason that the idiom of a poem written in Cornish, and called the *Passion*ⁿ, is not easily understood by the Welsh^o. It has also the character of being elegant and manly^p, pure, short, and expressive^q.

The most material singularities in this tongue are, that the substantive is placed generally before the adjective; the preposition comes sometimes after the case governed; the nominative, and governed case, and pronouns, are oftentimes incorporated with the verb; letters are changed in the beginning, middle, or end of a word, or syllable; some omitted, some inserted; and (much to the commendation of this tongue) of several words one is compounded (as in the Greek) for the sake of brevity, sound, and expression^r. There was nothing printed in this language till the learned Lhuyd published his Cornish Grammar. The MSS in the Bodleian Library have been already mentioned^s, to which I must add, that in the Cotton Library there is a Cornish Vocabulary^t; there are also several proverbs still remaining in the ancient Cornish, all favouring of truth, some of pointed wit, some of deep wisdom.

Neb na gare y gwayn coll restoua; He that heeds not gain, must expect loss.

Neb na gare y gy, an gwra deveeder; He that regards not his dog, will make him a choak-sheep.

Guel yw guetha vel goofen; It is better to keep than to beg.

Gura da, rag ta honan te yn gura; Do good, for thy self thou dost it.

Many proverbs relate to caution in speaking, as *Tau tavas*, be silent, tongue.

¹ Scawen, M S, page 3.

^m Ibid. page 3, from Boxhornius and others.

ⁿ See before, page 297, called Mount Calvary.

^o Ib. Scawen, ib. page 5.

^p Ib. page 27.

^q Ib. page 51, and in preface to the *Passion*,

Ibid.

^r Of which see Lhuyd's *Archæologia*, page 225, &c.

^s Page 295.

^t Printed in the Vocab. at the end of the *Antiquities of Cornwall*.

Cows nebas, cows da, ha da veth cowfas arta; Speak little, speak well, and well will be spoken again.

Of talking of state-affairs, there are some remarkable cautions:

Cows nebas, cows da, nebas an yevern yw an gwella; Speak little, speak well, little of public matters is best.

The danger of talking against the government is excellently represented in the following proverb:

Nyn ges giûn heb lagas, na kei heb scovern; There is no downs without eye, nor hedge without ears.

This language was spoke so generally in Cornwall down to the reign of Henry VIII. that Dr. John Moreman^u, Vicar of Menhynnet (alias Mynhinet) in Cornwall, in the latter part of that King's time is said to have been the first who taught his parishioners the Lord's Prayer, Creed, and Ten Commandments, in the English tongue. When the Liturgy, at the Reformation, was appointed by authority to take place of the mass, the Cornish desired^v that it should be in the English language, being apprehensive that it might be enjoined them in their mother tongue, as it was with regard to the Welsh. By this means, and the gentry's mixing gradually with the English, the Cornish language lost ground in proportion as it lay nearer to Devon. In the parish of Pheoke the Cornish tongue resisted the scythe of time so long, that about the year 1640, Mr. William Jackman, then Vicar thereof, was forced to administer the Sacrament to the communicants in the Cornish, because the aged people did not understand the English tongue^x. After the Restoration we find the Cornish surviving only in the more western parts, where the Rev^d. Mr. F. Robinson, Rector of Landawidnek, is the last that I have met with, who, not long before the year 1678, preached a Sermon in the Cornish language only^y. About fifty years since it was generally spoken in the parishes of Paul and St. Just, the fishermen and market-women in the former, and the tinners in the latter, conversing one with the other for the most-part in the Cornish tongue. A little before this time (*viz.* in 1700) Mr. Ed. Lhuyd before-mentioned (to acquaint himself with the Natural History and Monuments, but principally with the language, in order to perfect his *Archæologia*) came into Cornwall, and by the hints which he collected, and the especial assistance of Mr. John Keigwyn (a gentleman well versed in the learned languages, as well as his own) composed his Cornish Grammar. This he afterwards published in 1707, and being by that time thoroughly acquainted with the other dialects of the British tongue, was able

^u Native of South-hole in Cornwall, that is, f. Southill, alias Suthull, (as in the Lincoln Visitation) in Cornwall.

^v Scawen, ib. page 49.

^x "As he often told me," says Mr. Hals.

^y See Scawen's M.S., ib. ut sup. page 49.

to correct the errors of the modern Cornish, who, in many particulars, had greatly degenerated from the orthography of their fore-fathers, and wanted a reformer of such capacity to chasten and reduce their speech to the true radical original elements. His Grammar will preserve the rudiments of this language as long as his works remain, which will be as long as any regard for etymology and the ancient history of these kingdoms subsists. It lays a foundation also for correcting the MSS we have in this tongue, and by diligently examining, collating, and making proper extracts from the clearest parts of them, for perfecting a Cornu-English and an Anglo-Cornish Vocabulary.

That we may attend it to the grave, This language is now altogether ceased, so as not to be spoken any where in conversation; but as our ancient towns, castles, rivers, mountains, manors, seats, and families, have their names from the Cornish tongue, and as most of the technical names of mining, husbandry, fishing, and indeed some terminations of lands are in Cornish^z, it will in all ages be entertaining, and upon many occasions useful and instructive for this county to have as correct and copious a Vocabulary of its ancient language, as can be procured from the materials now extant.

SECT.XIX. In discoursing of the arts now practiced in this county, I intend
 The present state of arts in this country not to display their perfections, and applaud their late advances, but to point out their deficiencies, and hint at their improvement.

About fifty years since the principles and powers of mechanics were but little known among the Cornish: they generally drew the water from their mines by dint of human labour, which was extremely expensive, tedious, and impotent. Within these thirty years, their hydraulics are greatly improved, their horse-engines, water-wheels, and fire-engines are still growing more numerous, most of them now built by the natives, and gradually prevailing against inveterate customs, which are not to be got the better of all at once. These engines are still capable of farther improvement, particularly the horse-engine, called the Whim, whose cylinder, vulgarly called the Cage, which winds and unwinds the rope, I have observed in most places of too small a diameter, so that it has not the power it is capable of with equal labour: this whole machine also wants a proper check, so as that it might be easily controlled, or stop itself (as the fire-engine will do when the motion becomes too violent), for want of which many fatal accidents happen to men as well as horses. A thorough knowledge of mechanics is indeed so necessary to mining, that one would wonder how they could carry on mines here formerly with so small a

^z Antiquities of Cornwall, page 374.

share of it: at present the Cornish are very sensible of this, and there is such a constant call at one mine or other, that no man who is industrious, and understands mechanics, can fail of a handsome livelihood.

Our husbandry would doubtless admit of several improvements, Tillage. but two more obvious than the rest; as, first, ploughing and harrowing with large horses, instead of the present much slower progress of our oxen; secondly, of introducing the wheel-plough in many plain and even parts of the county, whereby the weight would be much diminished, and the work accelerated.

The wheel-carriages for timber and heavy loads may also be improved; for our butts and wains have only two wheels, and those of small diameter: the four-wheel waggons, for carrying hay and corn, are more capacious, and as the wheels support the burden and leave no dead weight on the cattle, are much to be preferred: the lighter carts also for expedition must much exceed our butts, and will carry more, but are not so much in use as might be wished: however, as the highways in most parts of the county have been of late years much widened, levelled, and repaired, it is to be hoped that the same method of carriage which experience has recommended to the most knowing and busy parts of the kingdom, will also soon take place here. It has been already hinted how easily our water-carriage may be extended, by making our rivers navigable either by leats and canals, or by locks, and the advantages accruing from thence to husbandry, and every other employ, are too apparent to be farther particularized.

Our fences, especially in the northern and western parts, might Fences. be bettered, that is, more commonly planted, which would make the partitions of our fields more lasting, as well as more sightly; and if tenants were encouraged, and obliged by covenant with their Lords to plant every new hedge they made, not only with quickset, but with young saplings of oak, ash, elm, or sycamore, the desolate nakedness of stone and mere turf hedges in so mild a climate, would soon be at an end, and sufficient compensation made to the planters in fuel and shelter. We have many lands partly over-run with sea-sands, which sands, especially on the north coast, are of a very shelly, prolific kind^a; perhaps saffron might be cultivated in some of the most sandy soils to great advantage.

We have plenty of wool in most parts of this county; but this Wool. wool has been generally sold to chapmen, who travel on purpose to buy and carry it off, and 'tis neither carded, spun, or weaved, but in very few places. This being observed by some publick-spirited gentle-

^a See fands, page 83.

men, they undertook (for which they are greatly to be commended) to set up a woollen-manufactory in the town of Penryn, situated in Falmouth Harbour. This attempt hath succeeded (though now scarce past its infancy) according to expectation, and in its different branches already employs six hundred people. "The goods they make for sale, and which by repeated trials they find they can send to foreign markets as good in quality and on equal terms with other parts of the kingdom, are those which follow^b: Coarse broad-cloths, druggets, duffles of all kinds, bays's, barragans figured and plain, watered grograms, corded and figured everlastings, figured and plain duroys, plushes, durants, and shalloons, besides some other particulars not deemed standing articles. By such a variety of articles, they are at liberty to shift their hands in general from one kind of looms to another, till the majority of their workmen become capable of almost every different kind of weaving: this enables them to execute any extraordinary orders much sooner, and upon decline of sales abroad for any one sortment, transfer their labourers to another branch; by this means they need not discharge any of their servants, and also work up the different sorts of wool which the country produces, to the great relief of the industrious poor; whereas most part of the natural produce of the sheep was before, either sent into other counties to be manufactured, or into France in exchange for tea and brandy, to the inconceivable advantage of our rival nation, and of the most pernicious consequence to our own." It is to be hoped that no person, who is able to lend the least support to so useful an attempt, will suffer it to decline for want of it. Again: We have the flax and thread for our pilchard-nets mostly from Bridport in Dorsetshire, nay even the nets are often made there; but it would be far more to the advantage of the Cornish, if the materials for netting were raised on the spot, and women and children employed in breeding nets, when the fishery is out of season, and bad weather sets in. Our common measure of grain is singular, and not so settled and uniform as it should be, the bushel varying in different parts of the county from sixteen to twenty-four gallons. The bushel in the eastern parts contains betwixt eighteen and twenty-four gallons, in the west is reckoned always to contain three Winchesters, or twenty-four gallons, and some will unjustly increase even this by a gallon or more, for the sake of raising the price of what they sell at home without the additional gallon, or in concert with the bakers, endeavouring to raise the market price, and thereby countenancing the making bread of short weight, conformable to that exorbitant price.

Flax and
nets.

Measure of
grain.

^b Letter dated August 27, 1757, from Mr. Richard Williams, Surgeon, of Falmouth, to whose affiduity and direction the present success of this undertaking is chiefly to be attributed.

In Cornwall the customary perch for land-measure is also eight-^{Land-}teen feet, though of late years most gentlemen comply with the statute-perch of sixteen feet and a half; but the most extraordinary measure of all, is the Cornish acre, which, according to Mr. Carew, (page 36, and Norden, page 26) contained two hundred and seventy statute-acres, which kind of account, says Norden, (who was surveyor to Henry Prince of Wales, and Duke of Cornwall, temp. Jac. I.) is not elsewhere in England. "Commonly, says Mr. Carew^c, thirty acres make a *farthing land*, nine *farthings* a Cornish acre, and four Cornish acres a Knight's fee; but this rule^d is overruled to a greater or less quantity, according to the fruitfulness or barrenness of the soil." Mr. Carew, it is not to be doubted, had his authority, though not cited; but whatever it was, the Cornish acre certainly varied much in different times and places from this assigned standard; for in the register of Lacy (Bishop of Exeter, A. D. 1420, page 419), the Cornish acre contained four ferlings [*alias farthings*], each ferling consisting of thirty acres statute-measure, each Cornish acre being deemed a *tenure*, and containing no more than one hundred and twenty statute acres, as appears by the following recital: "Item idem Thomas Abbas de Tavistoke XVI tenuras, &^e dim. consuetudinare prefati Manerii in libertatem demisit, quarum quelibet continet in se unam Cornubicam terræ, et quelibet Cornubica continet in se IIII ferlingas, et quelibet ferlinga XXX acras:" but even this measure was not always precise and invariable, for in the same register (pages 450 and 451) the several closes contained in a *ferlinga* or *farthing-land* make up thirty-two acres, consequently a tenure or Cornish acre of four such *ferlinga*'s makes one hundred and twenty-eight acres. Neither was the *ferlinga*^f always uniform; for sometimes it consisted only of ten acres^g.

Certain it is that acres were anciently of different extent in different places, and in general of greater extent than they are by the present computation; the Irish acre continued even to the last century to contain three of the English, but what were the precise contents of an acre among the Anglo-Saxons is uncertain^h. The present dimensions of an acre, *viz.* one hundred and sixty square perch of sixteen feet and a half, were settledⁱ by the 31 of Edw. I^h, and in the succeeding reign eight hundred such acres made a Knight's fee, but in Cornwall at that time four Cornish acres, containing one thousand and eighty statute-acres, were required to make up one Knight's feeⁱ.

What should be the reason that our fore-fathers so much exceeded the rest of this island in their land-measure, I do not presume to

^c Ibid.^d As to the Knight's fee.^e *Alias ferlingus*, Spelman, page 212.^f Decem acre terre faciunt secundum antiquam consuetudinem unam *ferdellam*, &c. Spelm. Gloss.

page 212.

^g Spelm. in voce *acra*.^h Ibid.ⁱ Carew, ibid.

determine;

determine; I conjecture, that the inhabitants having their resources for the necessaries of life from the bowels, and not from the surface of the earth, neglected the latter out of too constant an attention to the former. The soil and the surface therefore being uncultivated till the last ages*, inclines me to think that a greater quantity of land was requisite to make up an acre, and entitle a man to the honour of knighthood in Cornwall than elsewhere. Let it be considered in the next place, that the word acre did not always signify a determinate quantity of ground, but “*latum quantumvis agrum*”, that is, a field or tenement of any space; that whilst the lands lay in this coarse condition there were no divisions but those of tene-ments, which were usually granted by the Lords of the Soil in such dimensions as contained many of our statute-acres, and in any quantity which was thought at that time sufficient for the purposes of tillage and pasture; hence arose the term of the Cornish acre, meaning no more than a Cornish holding or tenement, *hile* or *tenure*, including more or less[†], according to the degree of cultivation[‡].

Earths.

For making porcelain, as well as preparing ochres and other painting-earths for the artist, a great many clays and mineral-earths may be found in Cornwall[§]; water-mills may easily be procured, fuel cheap, and water-carriage to London and Bristol so convenient on either side the county, that a sufficient undertaker might at least find as many encouraging circumstances to set up such manufactures in Cornwall as any where in England.

Salt.

Sea-salt may be made here as well as in French Britany, for the materials are the same, and in equal plenty in both countries, and the difference of climate inconsiderable, “it being found by expe-rience, says a modern author[°], that bay-salt made in Hampshire (farther within chanel than Cornwall) is not inferior to the bay-salt of Britany:” but supposing we could make in Cornwall but two thirds of the sea-salt which the Bretons make, this, if I am rightly informed, would very well answer. There is a place in the parish of Senan, about half a mile north of the Land’s-End, in which the traces of salt-works, carried on in the last age, are still to be seen; and tradition says, that the manufacture miscarried not through any deficiency of materials, or incongruity of situation, but through the neglect and dishonesty of the persons employed.

Vitriol.

About the year 1747, a curious foreigner[¶] set up a vitriol manu-facture near Reddruth. The water was collected from places where tin was burnt in order to discharge its mundic, and copper-

* See page 84.

† Spelman, *ibid.*

‡ In Lacy’s Register one hundred and twenty, in Spelman one hundred and sixty, in Carew two hundred and seventy statute-acres.

§ See page before, “Item idem abbas,” &c.

¶ See clays, page 63, &c.

° Nat. Hist. of Cork, vol. II. page 250.

¶ Dr. John James Rouby, now at Plymouth.

ores were most usually washed. This water, strongly impregnated with the vitriolic particles which these ores abound with, was first put into a large lead cistern, where it rested till the sediment subsided, and the water was clear: it was then conveyed into a boiler of the same metal, where it was kept constantly boiling by a gentle fire for seven or eight days, and when they found it ready, that is, by evaporation reduced to a proper pellicle (which they distinguish by the colour) it was drawn off through a cock at the bottom of the boiler, and set in leaden cisterns to crystallize, the salts shooting round the sides of the vessel, and fixing upon pieces of timber thrown in on purpose to collect them. The time required for crystallization was either three or five days, according to the weaker or stronger impregnation of the water; about eight tons of which, well impregnated with the vitriolic quality, would give a ton of blue, fine vitriol, each ton worth eighty pounds, or near it, and the expence of making each ton not exceeding fifty pounds, as I have been informed. The materials for making this vitriol are so cheap, and in such plenty, that the whole kingdom might be supplied with this salt from Cornwall alone, if necessary.

But of all arts, that which concerns most nearly the gentlemen ^{Art of assay-ing.} of this county to cultivate, is that of assaying metals, an art which should be much more generally known and practised, than it is at present, in a county so fertile in fossils.

The value of tin-ore is well known, of lead not so thoroughly, and the agents of the copper-companies are almost the only persons who assay copper-ore: here therefore ends all our docimastic knowledge, and we are not only obliged to take the word of the buyer (which may naturally be supposed somewhat in favour of himself) as to our lead and copper, but our cobalt, bismuth, splentre, manganese, and the like, lie utterly unknown and neglected: Great pity it is that so many gentlemen of fortune and inheritance as the mine-districts in this county may boast of, can find no link to associate themselves in so useful a design as that of employing a proper person, and erecting one or more assay-offices whereto every man at a small expence might have access for information, as to the value of his ore, and the nature of any new fossil which occurs.

In some counties publick premiums, exhibited at the expence of a subscribing society, have had the desired effect in furthering improvements of publick benefit; perhaps something of the same kind would be of use in this county, and greatly promote the inclosing commons, planting fruit and forest-trees, making the most and best-finished highways, improving the powers, or retrenching the expence of any hydraulic engine, discovering new and more effectual

effectual fluxes for metals ; manuring with Cornish marle, improving the pottery-ware, or even introducing the porcelain or delf-manufacture ; a design of this nature, animated by a few people of rank, from its own apparent and necessary consequences, would soon make its way into the approbation and patronage of every man of opulence and publick spirit, and would be a sure method of making the people more industrious, flourishing, and happy. But to encourage and promote arts most effectually in a country at such a distance as Cornwall is from the great centre of power and riches, nothing can contribute more, than that gentlemen of fortune and rank generally reside at their paternal seats, build, plant, and improve barren grounds, enforce justice, stimulate industry, excite emulation, reconcile disputes, and lead forth now and then into the reach of favour and reward latent merit ; such occupations as these might well become the time and attention of those of the highest rank, and the most affluent fortune ; they are rational and generous, diffusive of plenty and happiness, in the place which has the first right (the right of birth) to our affections ; they endear and hold fast the dependants of the gentry, preserve and advance their patrimonies, and need not in the least clash with or interrupt their more solemn duties to the Church and to the State.

C H A P. XXVII.

Antiquities which have occurred in Cornwall since the year 1753,

Urns.

PLATE xxix. Fig. i. page 298, is part of a curious urn ; the *ansa* solid ; the clay fine, well burnt ; neatly ornamented, with double, straight lifts round the edge and handle, and wavy lifts on the sides ; colour cinerous ; the shell three eighths of an inch thick. It was found under a large barrow or heap of stones, at Karn, in the parish of Morvah, 1754.

Fig. ii. ibid. A plain urn, inclosing human bones, found in Mr. T. Smith's garden in Newport, in the isle of St. Mary's, Scilly : it stood upon the natural clay, inclosed in a vault four feet six inches long, two feet three inches wide, about one foot three inches deep ; the sides of the vault were faced with stone, its covering, flat stones ; the run of the vault N. N. E. This is inserted as the only one yet discovered in the isles of Scilly, to shew that these Islanders had the same way of burning the dead, and preserving what the fire left unconsumed, as other ancient nations.

Coins.

Fig. v. and vi. are two gold-coins found at Karn-breh in the year 1749, with those published in the Antiquities of Cornwall,

page

page 242; they seem both of the same die and value, but the impression differently corroded by time and use, may, by being exhibited in both, tend to their explanation. I can say nothing decisive as to the symbols, but I conjecture that on the convex side there is the rude figure of a ship with two masts, and the sails spread; on the convex seems a representation of the terraqueous globe, encompassed in the middle with a zone *wavy*, which divides the upper from the under hemisphere. In the upper hemisphere are placed the sun and moon, in the under the lesser luminaries.

Fig. vii. and viii. ibid. are two different heads from any already published in Plate xix. of the Antiquities of Cornwall, page 242: the faces are bold, and not inexpressive, turned different ways; the reverses are charged with horses and wheels in the same style as most of those already published.

Fig. ix. ibid. is not an ill fancied head; the diadem and its clasp very distinct and uniformly set, and the robing of the shoulder plain and indisputable. In the reverse, the body of the horse is remarkably slender, the engraver, as I apprehend, being more intent to express the expedition and swiftness, than the natural shape and proportion of the creature. The coins are of their real size and shape. I have only to observe, that Bouteroue's coins of the ancient Gauls have neither the weight nor true shape expressed, because either worn with use, or covered or eaten with rust (says he, ibid. Introd. page 40). All published by him of this kind have plain legends, except B, page 55, which however on the reverse has something like the letters M A. They can give little aid therefore towards explaining this treasure of British antiquity found in Cornwall; but if one can make any certain conclusion from coins printed in such a manner, it must be that they were struck by a people well acquainted with the Greeks or Romans; they favour nothing of the antiquity, rudeness, and simplicity of those of Karnbrêh.

Fig. x. ibid. is the little peteril or storm-finck *, which was drawn by the late Mr. Jago before-mentioned, Chaplain of Loo. Of this bird, rarely found on the English coasts, Mr. Catesby in the Appendix to his Nat. Hist. of Carolina, &c. (page and tab. 14) gives us the following account: "The storm-finck or pittrel, is about the size of a chaffinch; the whole bird, except the rump, (which is white) is of a dusky, brown colour, the back being somewhat darker than the belly; the bill is half an inch long, slender, dark-brown, and crooked at the end: by opening the head of one of these birds, I found that the nostrils consisted of two parallel tubes, proceeding from within the head, and running half way along the upper mandible of the bill, forming thereon a protuberance; the

* The bird mentioned before, page 247, and referred to the explanation of this plate.

wings

wings extended an inch beyond the tail; the legs were slender; the feet were webbed, with a small claw on each heel without a toe: they rove all over the Atlantic Ocean, and are seen on the coasts of America, as well as on those of Europe, and many hundred leagues from each shore. Their appearance is generally believed by mariners to prognosticate a storm or bad weather, and I must confess I never saw them but in a troubled sea: they use their wings and feet with surprising celerity; their wings are long, and resemble those of swallows, with which they are equally swift, but without making angles, or short turns in their flight, as swallows do, but fly in a direct line. Though their feet are formed for swimming, they are likewise so for running, which use they seem most to put them to, being oftenest in the action of running swiftly on the surface of the waves in their greatest agitation, but with the assistance of their wings." To these observations Mr. Catesby adds its name from Clusius. The ingenious Mr. George Edwards (to whom the Natural History of Birds is so much indebted) justly observes (page 90) that "it is strange so small a bird should be able to subsist in such open seas, where they cannot rest but on the water, which is always pretty rough. Those I have seen were continually on the wing; they appear not but in tempestuous weather, near ships or land. These I saw screened themselves out of the wind under the stern of the vessel I was aboard of; they even seek shelter sometimes in the deepest hollows that are formed between the high waves of the sea, and wonderfully keep their stations there, though the waves run very swiftly; they flutter so near the surface of the water, that they seem to walk on it; for which reason, Mr. Albin says, they are called Peterils, because they imitate Peter's walking on the sea." Edwards of Birds, page 90⁹.

Roman roads in Cornwall.

In the Antiquities of Cornwall, book iv. chap. v. page 301, several evidences of the Romans being in Cornwall, and having made publick roads here are produced, and many more will probably appear upon farther search, attention, and enquiry, of which the following notes may be a corroborating testimony: It is suggested, (Antiquities of Cornwall, page 305) that one Roman road at least passed from the eastern parts through or near Truro; to confirm which, I find a tenement called Caerfôs (alias Caerfosou) that is, the castle or encampment on the Dyk or Fos, by which names the ancient ways are too frequently called to need farther proof; this tenement lies about a mile west of Granpont, adjoining to the present high road to Truro which is about five miles distant.

⁹ Albin's History of Birds, vol. III. page 87, table 92. Dampier's Voyages, vol. III. page 97.

" There

" There are the remains of a causey between Liskerd and Looe, near Polgover, the seat of Mr. Mayow, which, as well as the cross road from Dulo to Heasenford, vulgar tradition makes to be Roman :" That the Romans had ways in these eastern parts of the county about Loo and Lostwythyel, the following ancient work, shewn me by the Reverend Mr. Howel, Rector of Lanreath, (June 25 and 26, 1756) will abundantly confirm : It is called the Giant's Hedge ; a large mound which reaches from the valley in which the two boroughs of East and West Loo are situated, to Leryn, on the river Fawy* : It is first visible on West-Loo down, about two hundred paces above the mills, whence it runs to Kilmaenarth woods ; from and through them to Trelaun wood, about three hundred paces above Trelaun mills ; then through little Larnic to the Barton of Hall, in which there are two circular encampments about four hundred paces to the north of it ; thence quite through the said Barton, making the northern boundary of a field on the glebe of Pelynt Vicarage, called Furz Park ; then cross the Barton of Tregaric, and thence through the north grounds of Tresaffon and Polventon to the glebe lands of the Rectory of Lanrêath, where I measured it seven feet high and twenty feet wide at a medium ; thence it stretches through the tenement of Wyllacomb to Trebant water, whence it proceeds through the Barton of Langunnet and some smaller tenements to Leryn, from which there is a fair dry down, called St. Winnow Down, leading north along to Lostwythyel. This Risbank, or mound, ranges up-hill and down-hill indifferently ; has no visible ditch continued on any brow of a hill, as intrenchments always have ; there is no hollow or foss on one side more than the other ; it is above seven miles long, and tends straight from Loo to Leryn creek, in the direct line from Loo to Lostwythyel. By all these properties, its height and breadth, its wanting the fosses of fortification, its straightness and length, the grandeur of the design, and the labour of execution, I judge, that it can be nothing less than a Roman work ; in this supposition I am the more confirmed, first, because several Roman coins have been found on the banks of Fawy river, (as see Antiquities of Cornwall, page 282) and as I have been informed also in the run of this notable work ; secondly, by its tendency to the first ford over the navigable river of Fawy ; for it must be observed that the Romans thoroughly sensible of the delays and hazards of crossing firths and arms of the sea, and the danger of bridges getting into the possession of the natives, were equally adverse both to bridges

* Letter, April 25, 1755, from J. Trehawk, Esq; to whose kind communications the preceding sheets are much indebted, especially with regard

to the Geography of the County.

* Alias Fowey.

* Letter from the forementioned gentleman,

and passing large rivers; they had therefore in constant view the nearest and most commodious fords of rivers, and directed their roads accordingly; now near Leryn creek, where this work ends, there is a ford, and no where below is the river Fawy fordable, which plainly accounts for their carrying this road so high up in the country, that it might at once convey their troops towards their station at Lostwythel, and afford them a safe passage over the river Fawy into the western parts, through Granport and Truro.

Thus, my Countrymen, you have my observations on the most important points of the Natural History of Cornwall, and if from the want of any thing within your reach here suggested, ye attend to the improvement and cultivation of science, and from the great plenty of all things necessary to life, as well as of things in their own nature rich and peculiar to your Country here exhibited, ye learn to praise and adore the Gracious Giver; the Author has his ends, and is content with having pursued those ends to the best of his power: he takes his leave therefore secure of the candid allowances which will be made for a work so various and on subjects so undecided, still opening more and more to the inquisitive Naturalist, yet in many particulars still retiring from full and adequate conviction; known only enough to shew beyond contradiction the goodness, power, and wisdom of God; and yet sufficiently known, as being equally intended to exercise the patience, gratitude, devotion, and humility of man.

F I N I S.



E R R A T A.

N. signifies NOTES. Other ERRATA are in the TEXT.

<i>Page line</i>	<i>for</i>	<i>read</i>	<i>Page line</i>	<i>for</i>	<i>read</i>
viii 1	Catagogue	Catalogue	119 14	a passage repeated by mistake from page 96.	
ib. 27	that	this	119 25	singl-dispers'd	single and dispers'd
2 8	Fauwy	Fawy	120 11	termining	terminating
3	in Note f dele (--, infert " from, in time to the end in Note l.		120 39	xii	xix
4 4	Dacanatus	Decanatus	129 11	more plenty	in more plenty
5 27	Tracks	Tracts	131 26	a Pyrites	Pyrites
7 27	Vapours, used for exhalations in general.		142 36	are equally	both equally
16	Dele colour at the bottom of the page.		144 14	Dele ()	
26 31	Occasioned	occasion	150 1	Dele between	
33 15	Possitively	positively	162 2	thongh	though
34 4	Discernable	discernible	165 18	subtraction	subtraction
ib. 40	Naphtha	naphta	171 1	Insert) after shaft	
35 9	Iron being	Iron is	179 5	Waft	waste
41 1	Dele Here is a stone bridge of 15 arches.		189 N. x	Roswarn	Roswarne
ib.	Dele N. c repeated		194 26	xiv	xvi
49	N. * J. Fréhawk, Esq;	{ J. Trehawk, Esq,	195 38	ocre	ochre
53 12	Carelew	Carclew	212 N. q	see above	See before
ib.	N. x 1754	1757	217 23	County	Country
55 21	The wind was fresh	The wind-fresh	219 20	Insert w the mark of reference to N. w	
78 29	Mountians	Mountains	219 N. * does ripen	{ well	{ does not ripen well
81 8	Dele, the		221 14	dele ()	
81 32	near four miles	full four miles	224 20	pluck'd this	pluck'd branches of this
85 23	which Grew *, dele *, and insert it below at aire, line 41		227 13	Pedunculi	pediculi
86	N. * tempus ab	{ tempestas	ib.	ib. Peduncule	pedicule
	Euro		235 21	fame	fame Gentleman
102 24	Standard-water, dele the hyphen		240 9	Fig. x	Fig. viii
104 24	in the inland	{ in an inland country	241 21	dele not	
109 13	phænomina	phænomena	247 6	enabling them	enabling these birds
	N. B. The numbers applied to the different samples of Pebbles, Porphyry, Talc, Arbeftos, and small gems in the 10th Chapter, refer to the marks in the Author's collection, all which specimens are intended to be deposited in the Museum Ashmoleanum, Oxford, for the satisfaction of the curious.		250 12	its, it,	her, she, or other like insect
115 38	insert a comma at have,		253 35	or other	languid
117 35	forms	form	256 19	lanquid	
118 25	diamond, substance	Diamond-substance	258 { 19	ten-cles	{ tentacles
			259 24	mammillæ	
			259 36	ocre	ochre
			260 21	same size	natural size
			265 35	Aredi	Artedi
			271 1	dele (
			284 27	the Phoca	Phoca
			287 31	Maddern	Madern
			294 3	the most	a most
			305 38 r	inverted in merited	

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